United States
Department of
Agriculture

Forest
Service

April 2020

Hydrology and Aquatic Species Report and Biological Evaluation

Big Summit Wild Horse Herd Management Plan Environmental Assessment

Ochoco National Forest

Lookout Mountain and Paulina Ranger Districts

Prepared by:

Jon Kochersberger, Hydrologist

Jennifer Mickelson, Fisheries Biologist

Table of Contents

Hydrology and Aquatic Species

Introduction

This section includes the Biological Evaluation (BE) for Threatened, Endangered, and Sensitive aquatic species in the Big Summit Wild Horse Territory (BST) project area. The BE documents the review and findings of the Forest Service planned programs and activities for possible effects on species (1) listed or proposed for listing by the US Fish and Wildlife Service (USFWS) as Threatened or Endangered; or (2) designated by the Pacific Northwest Regional Forester as Sensitive; or (3) required consultation with the National Marine Fisheries Service (NMFS) under the Magnuson-Stevens Fishery Conservation Act (MSA). It is prepared in compliance with the requirements of Forest Service Manual (FSM) 2630.3, FSM 2672.4, and the Endangered Species Act of 1973, as amended (ESA) (Subpart B; 402.12, Section 7 Consultation). The R6 Regional Forester's Special Status Species List from 2015 will be used.

Pertinent Rules and Regulations

Water Quality

Direction for managing water quality, water quantity, and riparian areas on the Ochoco National Forest are found in the Forest Service Manual, Title 2500 - Watershed and Air Management (FSM 1984), Forest Service Inland Native Fish Strategy Environmental Assessment (INFISH 1995), Code of Federal Regulations (36 CFR 219), National Best Management Practices for Water Quality Management on National Forest System Lands (BMP 2012), the Clean Water Act (CWA 1972), Executive Orders 11988, 11990 and 12088, the Organic Administration Act of 1897, Watershed Condition Framework (U.S. Forest Service Watershed Condition Classification Technical Guide, 2010) and the Ochoco National Forest Land Resource and Management Plan (LRMP 1989).

The goals and objectives of Ochoco National Forest along with desired future conditions can be found in the Ochoco National Forest Land Resource and Management Plan along with Forest-Wide standards and guidelines for water.

Management Area Prescriptions – Riparian

A management area is composed of lands with similar capabilities or characteristics and is allocated to emphasize a resource or mix of resources. In conjunction with Forest-wide standards and guidelines, management areas provide a site-specific management emphasis and desired future condition for that area.

Riparian areas include land adjacent to water, where plants that are dependent on a perpetual source of water occur. They normally have high water tables and soils which exhibit characteristics of wetness. Riparian areas provide food, cover, and a source of large woody material for aquatic insects, fish and land animals. The vegetation of streamside areas filter sediment and shade the water surface to help maintain stable stream temperatures. Management emphasis for riparian areas include managing streamside vegetation and habitat to maintain or improve water quality. This includes meeting temperature and turbidity levels as required by state standards under the Clean Water Act. In summary, desired future condition for riparian areas include a low, but apparent level of management, adequate shade from deciduous and coniferous vegetation, diverse vegetation, and banks that are well vegetated and protected. A complete list of desired future conditions for riparian management areas can be found in the Ochoco Forest Plan (USDA Forest Service 1989).

Management Area Standards and Guidelines - Water

<u>Temperature – Standard and Guideline</u>

- The requirements for shade along streams will generally correspond to provisions for more than 80 percent of the surface shaded. Where this cannot be attained, 100 percent of the potential for shade is the standard.
- Shade requirements may be reduced in cases where management is necessary to sustain a thrifty community of shade providing species over time, but activities may not result in an increase in temperatures above the limits specified (MA-F15 Riparian).

Turbidity – Standard and Guideline

- Allow no more than 10 percent cumulative increase in stream turbidity. Short-term (less than five days) deviations from this standard to accommodate emergency or other legitimate activities will comply with state requirements for notification and approval (MA-F15 Riparian).

Project Activities – Standard and Guideline

- Special attention shall be given to land and vegetation for approximately 100 feet from the edges of all perennial streams, lakes, and other bodies of water. This area shall correspond to at least the recognizable area dominated by the riparian vegetation. No management practices causing detrimental changes in water temperature or chemical composition, blockages, or deposits of sediment which seriously and adversely affect water conditions or fish habitat shall be permitted within these areas.
- Preferential consideration shall be given to riparian-dependent resources over other resources in cases of unresolvable conflicts.

Vegetation and ground cover requirements

- Where site potential and topographic factors permit, manage riparian areas to provide the shade necessary to meet stream temperature goals.
- Maintain upper streambanks in a stable condition along at least 80 percent of the length of a stream.
- Retain at least 80 percent of the potential ground cover in grass-forb riparian communities. Also, retain at least 80 percent of the potential tree or shrub cover in riparian areas dominated by trees or shrubs. In riparian areas with mixed layers, the cover requirement may be met by taking credit for the effective cover provided by all vegetative layers of the riparian community including shrubs, tree understories, and the dominant overstory. Consider the mitigating effect of stream size and orientation as well as surrounding topography when determining the amount of cover that may be removed.

Inland Native Fish Strategy

Inland Native Fish Strategy (INFISH) (USDA Forest Service 1995a) provides direction to protect habitat and populations of resident native fish outside of anadromous fish habitat in eastern Oregon, eastern Washington, Idaho, western Montana, and portions of Nevada. For the Territory, INFISH provides protection for resident Inland Columbia Basin Redband trout (*Onchorhynchus mykiss gairdneri*).

Riparian Management Objectives (RMOs) describing good habitat were developed to describe desired condition for fish habitat (USDA Forest Service 1995a; USDA Forest Service 1995b; Rosgen 1996; Rosgen and Silvey 1998). INFISH Riparian Management Objectives that will be discussed in this report relate to pools, temperature, bank stability and width to depth ratios. These parameters are indicators of effects to Redband trout and Columbia spotted frog habitat as a result of wild horse management. Although sediment is not an INFISH RMO, it is an indicator of effects to Redband trout and Columbia spotted frog and will be discussed in the effects section of this report.

There is one standard and guideline specific to wild horse and burro management. It states:

- GM-4: Adjust wild horse and burro management to avoid impacts that prevent attainment of Riparian Management Objectives or adversely affect inland native fish.

Implementing INFISH is to achieve a high level of habitat diversity and complexity through a combination of habitat features, to meet the life-history requirements of the fish community inhabiting a watershed. Project proposals are to not retard the attainment of RMOs. To "retard" would mean to slow the rate of recovery below the near natural rate of recovery if no additional human caused disturbance was placed on the system (USDA Forest Service 1995a p. A-3).

Riparian Management Objectives

Riparian Management Objectives (RMOs) describing good habitat were developed to describe desired condition for fish habitat. The reference information for RMOs better describe the habitat in the Territory than INFISH.

Table 1 is taken from Table A-1. Interim Riparian Management Objectives (RMOs) from INFISH (USDA Forest Service 1995a). As discussed below, some of these INFISH standards are used to describe aquatic conditions in the Territory. Additionally, desired conditions are included based on best available science for the area.

Table 1: Applicable Riparian Management Objectives for the Territory (USDA Forest Service 1995a). Large wood is not discussed because large wood is unaffected by wild horse management.

Habitat Feature	**Interim Objective**	**Desired Condition Based on Best Available Science For the Area**
Pool Frequency (all systems)	Varies by channel width: Wetted width (feet): **10** 20 25 50 75 100 125 120 200 Pools per mile: **96** 56 47 26 23 18 14 12 9	Same as Interim Objective
Water Temperature	No measurable increase in maximum water temperature (7-day moving average of daily maximum temperature measured as the average of the maximum daily temperature of the warmest consecutive 7-day period). Maximum water temperatures below 59F within adult holding habitat and below 48F within spawning and rearing habitats.	Oregon State standards (340-041-0028, approved by EPA Mar 2004): the seven-day-average maximum temperature of streams identified as having salmon and trout rearing and migration should not exceed 18.0ºC (64.4ºF).
Bank Stability (non-forest systems)	>80 percent stable.	Same as Interim Objective
Width/depth ratios (all systems)	<10, mean wetted width divided by mean depth	Refer to Table 3

Aquatic Species

This report analyzes the effects of proposed project alternatives upon fish, amphibians, and aquatic resources in the Territory. Sensitive species that are listed as documented or suspected on the latest Regional Foresters Sensitive Species list for the Ochoco National Forest are analyzed for potential effects, while other species are not specifically analyzed for potential effects. There are two aquatic sensitive species within the Territory, resident native Inland Columbia Basin Redband trout (*Oncorhynchus mykiss gairdneri*) and Columbia spotted frog (*Rana luteiventris*), which are found in the following stream systems: Duncan, Blevins, Douthit, Ochoco, Canyon, Kyle, Judy, Scissors, Cady, South Fork Howard, Cram, Winter and Johnson Creeks. Other small unnamed perennial and intermittent streams also exist. Proposed activities and potential effects have been compared to Forest Plan standards and guidelines to determine consistency.

Management Indicator Species Occurrence and Status

Forest Plan designation - Brook and rainbow trout

Fish species identified as Management Indicator Species (MIS) are listed in the FEIS for the Forest Plan. These species are rainbow trout (*Oncorhynchus mykiss*) and brook trout (*Salvelinus fontinalis*). In the past, both species were stocked on the Forest by the Oregon Department of Fish and Wildlife (ODFW). ODFW no longer stocks either species on the Forest.

Brook trout are a non-native trout that were planted for fishing opportunities in the 1920s and 1930s. They are known to exist in only a few streams on the Forest, but not within the Territory.

For purposes of this analysis, Redband trout are described in the Threatened, Endangered, and Sensitive Species section and will act as a surrogate for MIS fish species effects analysis (Rife, 2011). Additionally, effects to Redband trout are considered to be the same as effects to brook trout. An MIS analysis is located later on in this document.

Threatened, Endangered, and Sensitive Species Occurrence and Status

There are no known Threatened or Endangered aquatic species or designated critical habitat within the Territory, under the federal Endangered Species Act (ESA). Therefore, regulatory ESA consultation procedures are not applicable to the territory. Columbia spotted frog and MIS-surrogate, Redband trout, are the only two USFS Region 6-designated aquatic Sensitive species known or suspected to inhabit the Territory. Species listed as Strategic are not addressed in this analysis.

USFS Pacific Northwest (Region 6) Sensitive Listed Species (2015)

The following USFS Region 6 sensitive aquatic species are included in this Biological Evaluation (Table 2).

Table 2: Analyzed aquatic species, their Forest-wide status, and occurrence within the territory.

Species	Scientific Name	Status	Occurrence
Columbia spotted frog	*Rana luteiventris*	S	HD/D
Redband Trout	*Oncorhynchus mykiss gairdneri*	S	HD/D
S: Sensitive per 2015 Regional Forester's Special Status Species List; HD/D: Species and Habitat Documented or suspected within the project area or near enough to be impacted by project activities			

Analysis Design

The following components of the aquatic ecosystem were not analyzed for this project:

- Roads are a major source of erosion and stream sedimentation on forested lands. Roads can increase erosion rates and turbidity three orders of magnitude greater than the undisturbed forest condition (Megahan 1974). Sediment eroded from the road prism can be delivered to a forest stream, resulting in increased turbidity, sediment loads, and degraded habitat for fish. Research has shown that roads have the greatest effect on erosion relative to other forest management practices (Megahan and King 2004). There are ~154 miles of Forest roads within the Territory that are affecting the existing condition of the streams within most of the area; however, no road management actions are being proposed as part of the project.
- Water yield is particularly affected by changes in the water budget, which includes changes to precipitation, evaporation, and transpiration from vegetation, infiltration, and runoff. Changes in water yield can influence bank erosion, stream temperatures, stream form, and habitat for fish. Grazing by wild horses has very limited impact on changes in water yield; however, bank instability and erosion caused by large ungulates frequenting riparian areas can lead to changes in channel morphology. Resulting channel incision can reduce connection to floodplains and therefore reduce potential water retention across a valley section (Davie and Boyd, 2019). In addition, no tree removal will occur under any alternative.
- Large woody debris (LWD) is an important feature in streams across the Ochoco National Forest. It helps slow the flow of water, traps gravel that is important for fish spawning habitat, helps decrease water temperature, provides hiding cover and habitat for fish, helps reinforce streambanks and traps organic material. LWD is unaffected by wild horses because they do not remove active or potential large wood from the landscape. Therefore, it will not be discussed further in this analysis. It should be noted that it can be inferred that the greater the presence of LWD in a stream the less the potential horse utilization and potential riparian degradation through inaccessibility.

  Of the four sub-watersheds that encompass the Territory, there are parts of the sub-watersheds that lie outside of the project area. Similar effects to riparian conditions exist in these areas and horse numbers likely have an effect as they do inside of the Territory but will not be analyzed.

Methods

Watershed Condition Framework

In 2010 and 2011 there was a national initiative to establish the existing 'watershed condition' for each 12-field subwatershed on every National Forest. The primary intent of doing so was to establish a systematic process for determining watershed condition class that all National Forests could apply consistently and to improve Forest Service reporting and tracking of watershed condition.

The product of this effort was a baseline watershed condition class established for every subwatershed on every national forest. With an established baseline, condition could be tracked over time with events and projects such as riparian and upland restoration, wildfires or any other event that may change watershed condition.

Stream Surveys

PFC, also known as Proper Functioning Condition (USDI, 2015 TR 1737-15 and the Supporting Science for Lotic Areas, Bureau of Land Management, USFS) is a methodology for assessing the physical

functioning of riparian and wetland areas. The term PFC is used to describe both the assessment process, and a defined, on-the-ground condition of a riparian-wetland area. In either case, PFC defines a minimum or starting point. In the Territory, there were four streams and 16 stream reaches surveyed for PFC in 2015.

Level II (Region 6 Stream Inventory Level II Surveys, US Forest Service) and Bottom Line Survey (BLS; The Bottom Line Survey: An Approach to Evaluate the Attainment of Riparian Area Standard and Guidelines on the Ochoco National Forest, USFS 1992) data have been collected in the Territory. Information from these data sets can serve as a useful tool in evaluating the condition of streams as well as a benchmark for monitoring trends. All of the most recent survey data was compiled and analyzed and was comprised of a mixture of BLS and Level II data from 1992-2016. It is recognized that the data are not entirely reflective of current management (last 3-5 years). For some of the stream systems there is data from the early 1990s and 2000s which has been compared to recently collected data (2009-2016). Using this, assessments of current conditions and trends in habitat are assumed to be reflective of management action effectiveness. Evaluation of streams with only recent data was compared to RMOs to determine habitat condition as long term trends could not be determined. Extrapolations will be made from currently collected data across the entire project, since data was not collected on every stream.

This analysis acknowledges that inherent variability and observer error exists in the measurement of the various aquatic parameters collected under the individual stream survey methodologies. This analysis assumes that in general, the error/variability in the measurement of each of the aquatic parameters is 5%. Therefore, no determination of consistency of an individual parameter to a specific standard or guide should be inferred if the measured value was within 5% of the standard. For example, the standard for stream shade for a specific site is 80%, if shade on the site was measured at 76% we would not be able to state with confidence that the standard is not being met because it falls within the 5% error/variability. Similarly, no determination of trend was applied to the comparison of more than one measure if the values were within 5%. For example, if stream shade was measured at 68% in 1995, and re-measured in 2006 at 71%, we would not be able to state with confidence that an upward trend exists.

PACFISH/INFISH Biological Opinion Effectiveness Monitoring Program data were utilized in select streams (2001 through 2019) (USDA Forest Service 2019). The following parameters were used to evaluate stream conditions that contained PIBO monitoring sites: pool frequency, width to depth ratios, percent surface fines, percent stable banks, and large woody debris frequency.

Indicators

The indicators below are used to qualitatively assess the effects of each alternative. A qualitative assessment of the effects is used to compare how each indicator would change with the different AML for each alternative. The indicators, along with how they are measured, are listed below. These indicators are also used to assess if each alternative is consistent with INFISH and the LRMP.

Sensitive Species Habitat (Channel Morphology)

The width-to-depth ratio is an index of the cross-sectional channel shape, where both width and depth are measured at the bankfull level. Changes in discharge, bank stability, sediment load and/or bedload can rapidly alter the width and/or depth of the channel. Whether a stream erodes downwards or outwards or both can be influenced by bank shear stress, channel substrate type and the amount of riparian vegetation present on stream banks. Bank vegetation increases the resistance to erosion through its soil binding effects on banks, with erosion decreasing as the percentage of roots in the soil increases.

Bankfull width/depth ratios are primary indicators of channel stability and thus are directly related to both pool quantity and quality. Channel width and abundance of large woody debris have been found to strongly influence pool frequency (pool to pool spacing) in forested streams and is an indicator of whether a stream can properly dissipate and distribute flow energy and transport sediment (Seixas et al. 2020 and Montgomery et al. 1995). An inverse relationship between bankfull width and pool to pool spacing has

been well documented by Rosgen (1996). For example, a stable B-type channel with a bankfull width of 10 feet will have about half the number of pools (88-132 pools/mile) when compared to a typical A-type channel that averages 5 feet wide at bankfull (264-285 pools/mile). Large woody debris loading will be unaffected by the alternatives proposed and any changes to AML.

INFISH (USDA Forest Service 1995) directs that channel width/depth ratios in streams that support bull trout populations be less than 10. In this watershed analysis area, some of the A, B and C-type channels currently have width/depth ratios that are greater than 10. Since the streams in the analysis area support Redband trout populations, not bull trout populations, which are more sensitive to habitat disturbances, a more desired condition may be those based on channel type as defined by Rosgen (1996). For example, field observations of redband trout have suggested that they are able to withstand a wide range of water temperatures as compared to bull trout (Idaho Power Company 2003). This coincides with the statement above that bull trout are more sensitive to habitat disturbances. See Table 3 for these ratios.

As the width/depth ratio increases, the surface area exposed to solar radiation also increases, potentially resulting in elevated stream temperatures. Streamside vegetation also becomes less effective in providing shade to these widened channels. Discharge amounts provided by the affected drainages in this watershed are not substantial in late summer, thus a reduction in the width/depth ratios in the affected drainages may not have any significant influence on downstream temperatures.

Width to depth is affected and changed by livestock use in streams and outer riparian areas. When livestock are more concentrated in streams and riparian areas, they trample banks and, in areas of heavy concentrations, can cause bank erosion. As banks erode, they become wider and shallower, increasing the width to depth ratio in the stream. As this widening occurs, it can destabilize riparian vegetation and cause continual increases in width to depth ratios. Over time, as width to depth ratios increase, riparian hardwoods and other riparian-dependent species will decline.

Existing condition for width-to-depth in the Territory streams was compiled from stream surveys and rated as poor, fair, or good. Good ratings indicate that width-to-depth is meeting the standard as described in Table 3. The table rates width-to-depth by channel type. If it meets the channel type width-to-depth, it is rated good, if it is within one number of good, it is rated fair; if it is more than one number away from good, it is rated poor.

Table 3: Width to Depth Ratio by Channel Type (Rosgen; Silvey 1998)

Channel Type	**A**	**B**	**C**	**D**	**DA**	**E**	**F**	**G**
Width/Depth Ratio	<12	>12	>12	>40	<40	<12	>12	<12

The entrenchment ratio is defined by Rosgen (1996) as the flood-prone width divided by the bankfull width. Flood-prone width is the width of the stream at twice maximum bankfull depth. Entrenched streams are typically vertically confined (within cutbanks) due to vertical channel erosion and have entrenchment ratios that are less than 1.4 (see Figure 1); higher entrenchment ratios indicate that channels are not confined and have access to floodplain. G and F-type channels are entrenched. Rosgen (1996) refers to the width to depth ratio as the bankfull width divided by the bankfull depth.

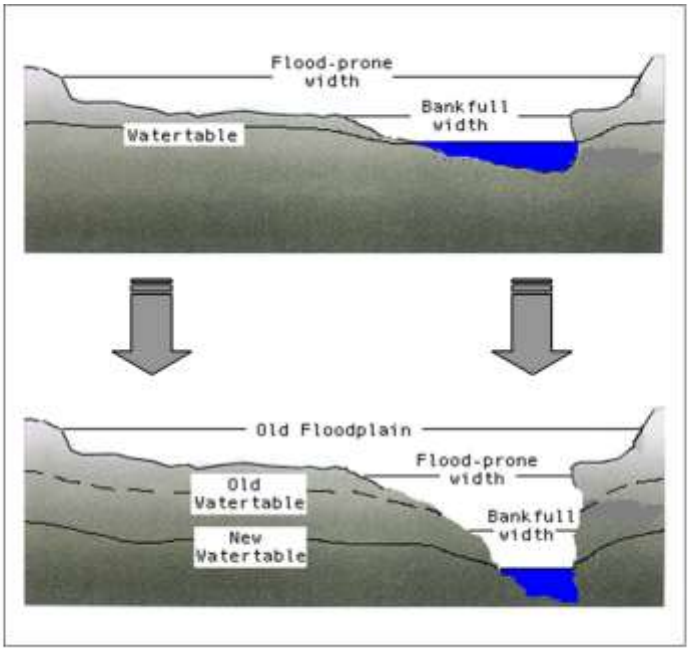


Figure 1: Changes in Channel Morphology and Water Table Elevation Associated with Entrenchment

Existing condition for entrenchment in Territory streams was compiled from stream surveys and rated as poor, fair, or good. Good ratings indicate that entrenchment is meeting the standard as described in Table 4. The table rates entrenchment by channel type. If it meets the channel type entrenchment ratio it is rated good, if it is within one number of good, it is rated fair; if it is more than one number away from good, it is rated poor.

Table 4: Entrenchment Ratios by Channel Type. (Rosgen 1998)

Channel Type	**A**	**B**	**C**	**D**	**DA**	**E**	**F**	**G**
Entrenchment Ratio	<1.4	1.4-2.2	>2.2	n/a	>2.2	>2.2	<1/4	<1/4

Stream Temperature

The temperatures in the INFISH Interim Riparian Management Objectives are based on bull trout presence or potential. Redband trout are the only salmonid currently present in the watershed. The Oregon Department of Environmental Quality did not identify any bull trout habitat in the planning area (Oregon Water Quality Standards, Fish Use Maps, Figure 130A). State water quality standards may be accessed at: www.deq.state.or.us/wq/standards.standards.htm. The Ochoco National Forest has incorporated into the LRMP to not measurably increase the 7-day moving average daily maximum water temperature on any adult holding habitat or spawning or rearing habitats in the planning area based on these interim RMOs. The state water quality standards more accurately reflect attainable conditions and target species (Redband trout) found in the Territory. The state standards (340-041-0028, approved by EPA Mar 2004) say the seven-day-average maximum temperature of streams identified as having salmon and trout rearing and migration should not exceed 18.0ºC (64.4ºF). The state of Oregon assumes that waters meeting this standard will provide water temperatures suitable for Redband trout spawning.

Within the Territory there are three streams with assessed water quality impairments related to summer water temperature. These include Ochoco Creek (14 miles listed), Canyon Creek (5.5 miles listed) and Howard Creek (9.5 miles listed). These streams are on Oregon's 2012 Section 303(d) List of "Water Quality Limited Waterbodies."

Reductions in solar input resulting from shading are a primary factor affecting stream temperature. The term "stream shade" often refers to all shade on any part of the stream that blocks solar input to the stream channel. Shade functions generally occur within 100-200 feet of the channel (Beschta, et al. 1987). Stream shade is primarily a function of stream orientation, channel width, tree heights adjacent to the stream, and ground slope above the bankfull channel.

On the Ochoco National Forest, the Forest Plan standards and guidelines direct that at least 80 percent of stream surfaces should be shaded, or that 100 percent of potential shade levels should be present when 80 percent shade cannot be attained (e.g. open wet meadow areas). Stream shade comes from adjacent conifer forests, topographic shading in steep drainages, or riparian vegetation near the stream. Open meadow areas are common in the watershed area and have a low potential for meeting the 80 percent shade criteria due to the absence of bordering forest and hillsides. The sources of shade in open meadows generally include sedges, rushes and other riparian vegetation that tends to flourish where the water table is high most of the year. However, many of the meadow systems in the Territory have been impacted to varying degrees by an assortment of legacy issues and past practices (e.g. undersized culverts, ditching, irrigation); therefore, it is assumed that a portion of the potential shade for these meadow areas cannot be met without active restoration.

Table 5: Summary of Stream Temperature Analysis Measure and Condition Status Rating.

Analysis Measure	**Parameter**	**Condition Status Rating**		
		Good	**Fair**	**Poor**
Stream Temperature	Shade	> 80%*	60-80%*	< 60%*
	7-Day moving average temperature	At least 90% of observations are meeting standards; <18°C	At least 50% of observations are meeting standards; <18°C	Over 50% of observations are not meeting standard; ≥18°C

* The requirements for shade along streams will generally correspond to provisions for more than 80 percent of the surface shaded. However, where this cannot be attained (such as in a meadow system), 100% percent of the potential for shade is the standard. Meadow systems would not meet the 80% stream shade standard but may still be properly functioning.

Existing condition of stream shade in Territory streams were compiled from stream surveys and rated as Good, Fair and Poor. Good ratings indicate that stream shade is greater than 80 percent; Fair conditions indicate stream shade between 60 and 80 percent; and a Poor rating is associated with stream shade of less than 60 percent (see Table 5).

In order to compare the proposed alternatives relative to stream temperatures in the Territory, monitored summer stream temperatures within and directly adjacent to the project boundary were compiled and 7-day-average maximum temperatures were determined for all sites. Observations of exceedances and trends were then determined through analysis.

Sediment/Turbidity

Environmental effects of unstable streambanks include increased turbidity and sediment yield, development of cutbanks, and changes in channel morphology. The result of these changes may result in water quality conditions that are lethal to many aquatic organisms. Changes in channel morphology would primarily be seen with changes in entrenchment and width to depth ratios (Marcuson 1977, Duff 1979). Streams with unstable banks typically erode laterally (i.e. become wider and shallower), which increases the width to depth ratio.

Turbidity is the degree to which suspended material in the water impedes light penetration. Turbidity is expressed in Nephelometric Turbidity Units (NTUs). There can be a close correlation between turbidity and suspended sediment in a given stream, but the correlation can change as organic material increases over the summer or if the percent of sediment from different sources in the drainage changes. The correlation is poor in sediment-limited systems. Turbidity is not a good indicator of the amount of total sediment being transported as bedload. At turbidity levels above 25 NTU salmonid sight-feeding may be reduced. Most measurable effects to aquatic life result from sediment instead of turbidity.

Current State water quality standards direct that turbidity levels should not exceed background levels by more than 10 percent. There is no quantitative standard for sediment in the current Oregon DEQ water quality rules. The Narrative Criteria section (340-041-0007-12); however, states that activities can not result in the formation of appreciable organic or inorganic deposits deleterious to fish or other aquatic life, but this is more of an objective than a standard. The State appears to be using turbidity as a surrogate for sediment.

The numerous organisms forming the base of the aquatic food chain find shelter and habitat in the open spaces within stream gravel and cobble. Filling these spaces with sediment reduces the habitable volume of the stream. As sediment sources and delivery exceed 20 percent of the total area on the substrate, deposits within the larger cobble material of the streambed produce an embedded channel, with consequent loss of aquatic habitat. Gravel embeddedness of less than 20 percent is essential to maintain a healthy salmonid population, particularly in those areas identified as potential or existing spawning areas (Bjorn and Reiser, 1991). If fine sediment exceeds 20 percent, the spaces between the rocks in the substrate are filled and oxygenation of eggs is reduced. Reduced oxygenation results in reduced success of fish and frog eggs surviving.

Soil disturbance on ridges or side slopes may never affect water quality, but disturbance of a channel bed or bank is immediately reflected in downstream sediment levels. Unstable stream banks associated with mechanical disturbance (including trampling), loss of vegetative root strength, decreases in roughness associated with LWD and vegetation removal, or channelized stream banks are highly susceptible to changes in flow or sediment load. These stream banks can account for most of the sediment load in a drainage system. If the discharge and/or the sediment load are substantially increased, the flow may erode the streambanks or deposit sediment to reach a new equilibrium. A high incidence of raw banks (i.e. cutbanks), headcuts, and/or braided channels (Rosgen channel type D) are indicative of unstable stream banks.

Two measurement factors were used to assess existing condition of bank stability for streams in the Territory: percent stable banks and percent fines from stream reach pebble counts. Each measurement factor was given a good, fair, or poor rating based on measured values. Percent Bank Stability was estimated and summarized from the most recent Level II and Bottom Line Survey data for each stream reach. Percent fines were estimated as percent of total particles that are less than 2 mm (median axis diameter) from Wolman Pebble Counts conducted as part of the Level II stream surveys for select stream reaches. Measurement factor values associated with condition ratings for the two surrogate sediment measurement parameters are summarized in Table 6.

Table 6: Summary of Sediment/Turbidity Analysis Measure and Condition Status Ratings

Sediment/Turbidity Analysis Measure	Parameter	Condition Status Rating		
		Good	Fair	Poor
	Bank Stability	>80%	60-80%	> 60%
	Fine Sediment	< 20%	20-40%	> 40 %

Riparian Vegetation

Riparian vegetation condition is important when assessing the existing condition and effects to streams, because it impacts not only stream shade, but bank stability, stream temperature, and stream form. In order to assess the riparian vegetation condition, estimates of hardwood shade from BLS and Level II Stream Surveys in combination with PFC Survey descriptions of riparian vegetation were utilized. Riparian vegetation condition was rated good if greater than 50 percent stream shade is from hardwoods, fair for 30 to 49 percent, and below 30 percent was rated as poor. The requirements for shade along streams will generally correspond to provisions for more than 80 percent of the surface shaded. However, where this cannot be attained (such as in a meadow system), 100% percent of the potential for shade is the standard. Meadow systems would not meet the 80% stream shade standard but may still be properly functioning. In absence of hardwood shade estimates, PFC Survey descriptions of riparian vegetation were used to rate the condition as good, fair or poor.

Existing Condition

Watersheds

The greater Territory resides within the Upper North Fork of the Crooked River and Upper Ochoco Creek watersheds which combined cover roughly 209,000 acres. The Territory covers 25,434 acres (~12% of the two watersheds combined acreage). The proposed action will be assessed using individual subwatershed boundaries within the Territory. These subwatersheds include: Headwaters of Ochoco Creek, Howard Creek, Johnson-Elliot Creek, and Duncan Creek-Ochoco Creek. Situated on the west side of the forest, the Territory is relatively moist, with a mean annual precipitation of 23 inches, ranging from 17 inches at lower elevations to 31 inches at the higher elevations.

Streams

Of the 58.4 miles of streams in the planning area, there are a total of 28.8 miles of perennial stream (Figure 2). Several year-round (perennial) and intermittent flowing streams drain the subwatersheds of the project area. These streams include: Blevins Creek, Cady Creek, Canyon Creek, Cline Creek, Cram Creek, Douthit Creek, Duncan Creek, Fisher Creek, Hedgepath Creek, Johnson Creek, Judy Creek, Kyle Creek, Madison Creek, Merritt Creek, Ochoco Creek, O'Neil Creek, Peaslee Creek, Scissors Creek, South Fork Howard Creek, and Winter Creek. Eight of these systems are classified as having year-round flow based on the United States Geological Survey (USGS) National Hydrography Dataset with the remainder identified as intermittent; however, it has been observed in recent years that the majority of these systems have lost late summer and early fall flows making them more functionally intermittent in nature. There are approximately 31 miles of fish-bearing streams (Class I-II) within the territory.

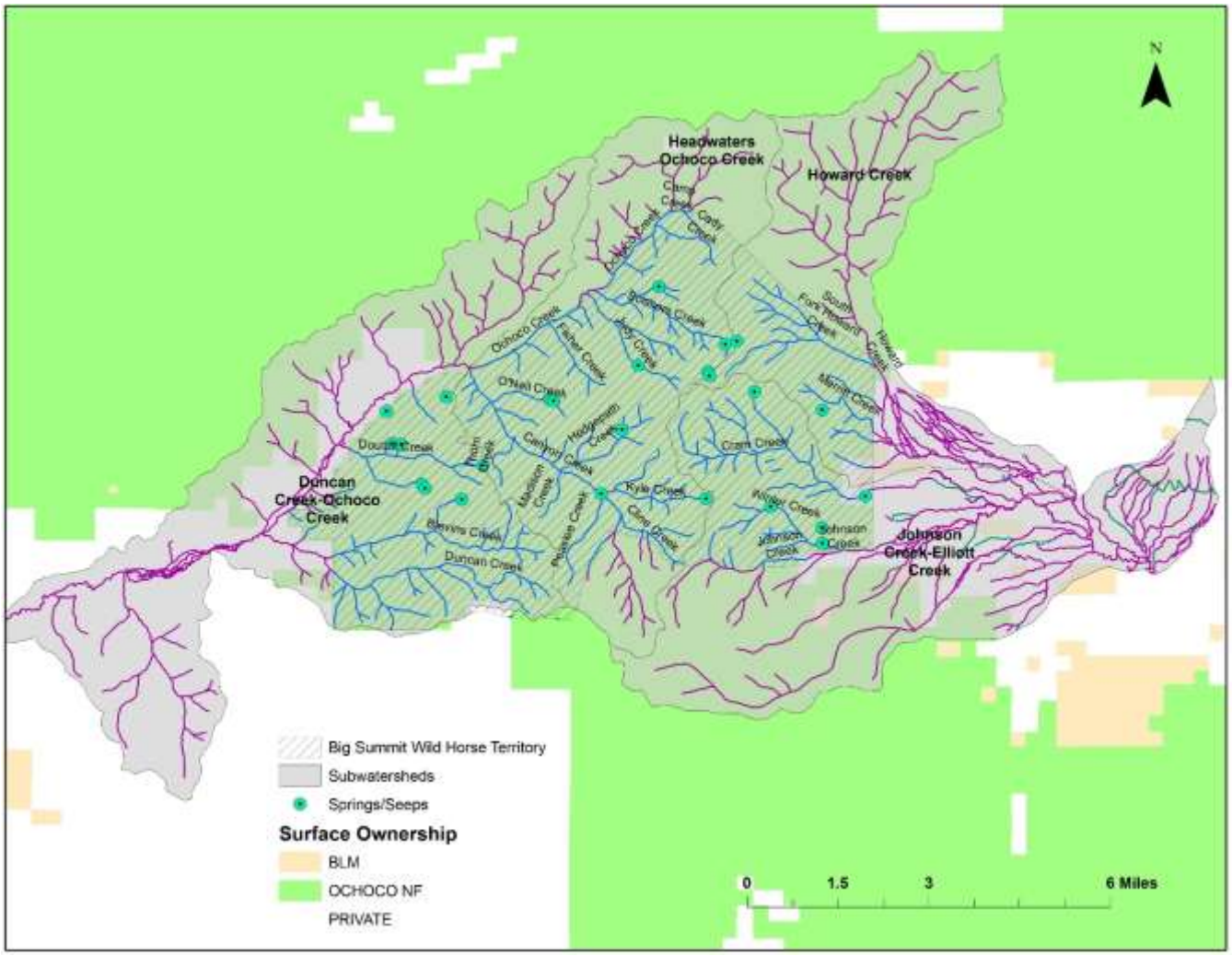


Figure 2: Streams and springs within the four affected sub-watersheds.

Sensitive Species

Redband Trout

Prior to human disturbance, Redband trout may have occupied more aquatic habitat within the Territory project area than presently. Road densities, wild horse and livestock grazing, timber harvest, and mining have contributed to a reduction in suitable habitat and increased fish passage barriers.

Redband trout typically inhabit cooler, well-oxygenated water that is less than 70°F, although they tolerate a wider range of water temperatures (from 32°F up to 80°F) better than many other salmonid species (Wydoski and Whitney 1979). Current research indicates that Redband trout have developed phenotypic traits that allow them to tolerate marginal trout habitats in the high desert areas of Oregon (Rodnick et. al. 2004, Gamperl et. al. 2002). Despite various phenotypic traits, the preferred temperature for optimum metabolic performance in Redband is 55.4°F (Gamperl et al., 2002) and the upper lethal temperature limits are 84.7-85.1°F, very similar to temperature profiles observed in most other *Oncorhynchus* species (Rodnick et. al. 2004).

Redband trout typically spawn between March and the end of June depending on water temperatures and timing of spring runoff. Egg deposition occurs in stream areas that have adequate water depth and velocity and appropriately sized gravels for redd construction. Water temperatures influence the number of days eggs incubate in the gravel before fry emergence. During the fry and parr life stages, Redband trout are often observed along stream margins in slower waters. Adults are most often observed in pools near large wood or available cover. Food sources for young and adults include aquatic insects, amphipods, fish and eggs and adults may also eat crustaceans when they are available (Wydoski and Whitney 1979).

There is little life history information specific for the populations in the Territory. Redband trout inhabit perennial streams in the Duncan Creek/Ochoco Creek, Headwaters Ochoco Creek, Howard Creek and Johnson Creek/Elliott Creek subwatersheds within the Territory.

Over the past 50 years (Stuart et al. 2007), lower numbers of Redband trout have resulted from the cumulative effects of loss of riparian vegetation (particularly hardwood trees), bank erosion, increased sedimentation (which can suffocate incubating trout eggs), entrenched streams, loss of beaver and woody debris, and altered stream channels.

Columbia Spotted Frog

Historically the Columbia spotted frog was found at elevations ranging from near sea level to 7,370 feet. Their range extended from southeast Alaska through British Columbia, eastern Washington and Oregon to northeast California and eastward to western Montana and Wyoming, and northern Utah. Columbia spotted frogs have been found throughout the Ochoco National Forest and are present within the Territory.

Columbia spotted frogs are highly aquatic, thus they are generally found near water in riparian habitat. In winter months, the frogs burrow into mud in wet meadows or in streams. They breed in shallow water areas such as stream margins or pond edges, flooded meadows, or in pools of water formed by snow melt from early March through the end of May. Timing of breeding is dependent on snowmelt and rising water temperatures. After hatching, the larval stage (tadpole) remains in the water until metamorphosis into the adult form. Adults utilize both water habitat and nearby riparian areas for foraging and refuge needs.

The causes of decline are not fully understood, but like most amphibians a major threat is the destruction, fragmentation and degradation of streams and wetlands. Land use activities have initiated or accelerated the channel incision process, which has changed the hydrologic function of meadow systems (USFWS 2011). These changes in the hydrology of meadows, mainly the lowering of the water table, can cause the vegetation communities to shift from wet meadow communities to dry upland plant communities. The

loss of meadow complexes reduces the available habitat for Columbia spotted frogs. Natural fluctuations in environmental conditions (e.g., drought) tend to exacerbate the adverse effects of land use activities (USFWS 2011). Improvements in stream and wetland hydrology and riparian plant communities would improve Columbia spotted frog habitat.

Formal Columbia spotted frog surveys have not been conducted, but frog sightings have occurred in the Territory. Vegetation preferred by frogs such as sedges, willows, and alders are limited, but available along some of the streams in the Territory. There is no information about their population size, distribution, growth, survival, life history diversity and isolation, or persistence in Territory subwatersheds. We assess the relative difference in potential effects to habitat for each alteration with the assumption that they are present throughout the territory.

Sensitive Species Habitat

For the Territory, channel width-to-depth ratios, entrenchment ratios, and number of pools per mile were analyzed for condition of sensitive species habitat.

Width to Depth Ratio

Based on the data from the surveys, the general condition of width to depth ratio of streams within the Territory can be generalized as fair to good with no apparent trend in changing conditions with the exception of Canyon Creek exhibiting an improving trend. Fairly stable stream banks have led to most of the channel adjustment occurring vertically (downward) rather than horizontally (to either side of the main channel) resulting in down-cut channels and narrower bankfull widths.

Entrenchment Ratio

Although entrenchment (vertical containment of a river) is not part of INFISH analysis, it is a reflection of streams degrading. Within the Territory, most of the streams exhibit poor entrenchment ratios which correlates with field observations of historic incision/down cutting of the stream channel in every stream and an overall disconnection from floodplains. Historic grazing, logging practices, and road building have contributed to the loss of high stream flow energy dissipating mechanisms such as large woody debris, access to floodplains at a variety of flows, stable stream pattern and high pool frequency. Recent data indicates no apparent trend in changing conditions which supports the assertion that most of these systems are existing in a stable degraded state because of poor streamflow access to the floodplain. This lack of floodplain access is in part due to lack of large woody debris within the channel to help capture sediment and raise the base elevation of the channel.

Pools

Pool characteristics are generally shallow exhibiting little habitat complexity. The majority of streams within the Territory fall well short of meeting management objectives of more than 96 pools per mile with no apparent trend in changing conditions (Figure 3). Streams that exhibit less than 50 pools/mile include: Cady Creek, Canyon Creek, Cram Creek, Douthit Creek, Duncan Creek, Howard Creek, Judy Creek and Scissors Creek. Data from 2015 indicates a drastic decrease in pools per mile from the 2001 data in Judy Creek in particular. The lack of pools in these systems can be directly attributed to conditions that create poor channel morphology such as lack of large woody material within the channel and loss of streamflow access to the historic floodplain.

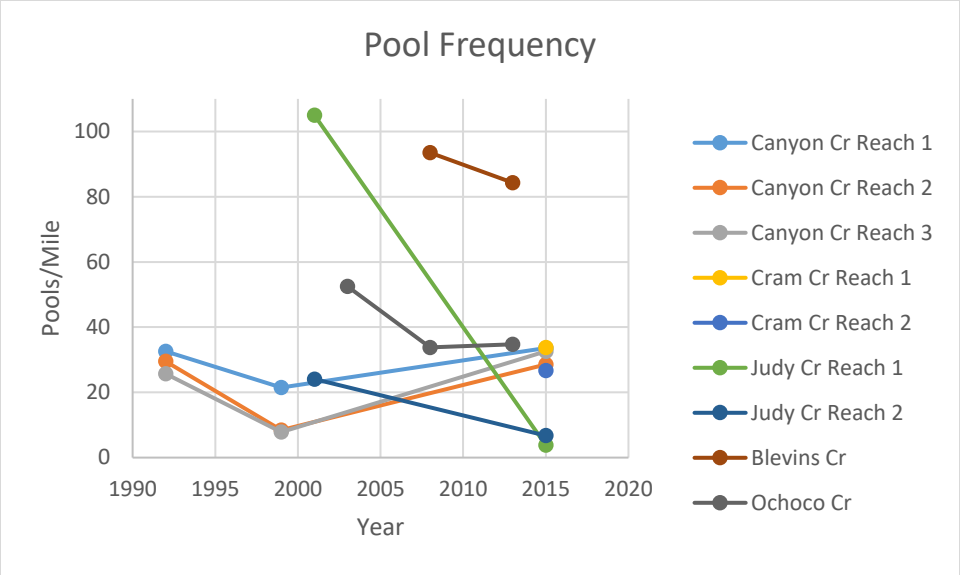


Figure 3: Pool frequency for selected stream systems within the Territory.

Stream Temperature

Temperature

Only a portion of the identified streams within the Territory have been targeted for long-term temperature monitoring; however, the streams where long term monitoring exist are the systems that have historically exhibited perennial flows. In general, most streams located within the Territory have exhibited a decreasing trend in stream temperature from measurements taken during the early 1990s. In contrast, measurements from Blevins and Duncan Creeks have highlighted an increasing trend in stream temperatures though these average maximum values have not exceeded RMO thresholds for adult holding water habitat.

Some of the streams that exhibit a decreasing trend in stream temperature continue to exceed the RMO threshold for adult holding water habitat of 59 degrees F. Ochoco Creek, Canyon Creek, and Howard Creek are currently 303d listed for water temperature.

Shade

Due to the forested nature of the territory, it was assumed that 80% of shaded surface was the minimum standard for all stream systems. Observations from data collected from the early 1990s through present indicate that most of the streams within the Territory were not meeting management objectives of 80% shaded surface or greater, though there is a trend of increasing shade for many of these systems. Much of the riparian hardwood vegetation contributing to an increasing shade trend appears to be a maturing Mountain/Thinleaf Alder component that has been observed in recent habitat assessments and field visits. Many species of Alder are known to colonize areas that experience infrequent but intense disturbance as well as repeatedly disturbed riparian areas (Harrington et al., 1994) and this supports the observation of increasing shaded stream surfaces even though other RMOs are not being met in many of the stream areas within the Territory. Recent data collected in 2015 and 2016 from Douthit Creek, Cram Creek (Reach 1), and Canyon Creek (Reaches 2&3) show LRMP objectives for shade are still not being met.

Riparian Condition

Poor riparian vegetation conditions across the Ochoco National Forest have resulted from historic grazing and logging practices, road building and channel incision which caused a lowering of local water tables in

the riparian zone. Riparian woody species (long rooted species) bind the soil together and create a stable streambank. The woody species also create a shaded climate for fish, frogs and insects that are fish and frog food. Woody species provide hiding cover from predators of Redband trout and Columbia Spotted Frogs. Data collection from 2015 PFC surveys highlight all of Blevins Creek as "Functional At Risk-No Apparent Trend." Most of Cram Creek was identified as "Functional At Risk-No Apparent Trend"; however, Reach 1 was identified as "Functional At Risk-Downward Trend" and on the verge of being non-functional. Reach 6 of Cram Creek was identified as "Functional At Risk-Downward Trend" with specific notes regarding 10 active headcuts and 22 wild horses using the area at the time of the survey. PFC survey data from Judy Creek in 2015 highlighted the uppermost Reach (5) as properly functioning: however, Reach 3 was identified as "Functional At Risk-Downward Trend" and Reach 4 identified as "Non-Functional" with evidence of recent erosion and sedimentation.

The Watershed Condition Framework assessment consisted of 12 indicators with 24 total attributes (the indicator value is an average of its corresponding attribute values). Aquatics Report Appendix A, Tables 1-4 shows how each of these indicators/attributes rated out for the four subwatersheds within the BST proposed action area. Each attribute had its own set of criteria for rating. The overall ratings for the Territory came out as 'fair/functioning at risk' for the four subwatersheds (see Aquatics Report Appendix 1, Tables 1-4). Those common attributes for riparian areas for the four subwatersheds within the Territory that received a rating less than 'good' are:

- Riparian/Wetland Vegetation- rated out either "fair" or "poor" or
- Aquatic Habitat- rated out either "fair" or "poor"

Springs

There are a total of 25 identified springs located in the Territory. There are 13 identified unnamed springs along with Crooked Tree, Chuckwagon, Davis, Douthit, Hedgepath, Judy, Kyle, Mary's Trough, Monument, O'Neil, Scissors and Winter Springs. There is no established monitoring schedule for these springs; however, some of them have been targeted for Groundwater Dependent Ecosystem (GDE) Level I Inventory surveys in the past and recent surveys of many of these springs have occurred in 2019. Year-round use by wild horse numbers in excess of the established AML appears to be contributing to the degraded conditions of several springs and seeps within the Territory. An October 2015 GDE survey conducted on an unnamed spring East of Winter Spring within the Territory highlighted detrimental effects from ungulate grazing to include what appeared to be frequent horse utilization given the number and concentration of horse tracks in the immediate spring area. Soil alteration identified during the survey included compaction, displacement, erosion, pedestals and slumping. The vegetation composition and condition were identified as not meeting management indicators as well as herbivory adversely affecting the site. These conditions are similar to what has been observed at Douthit and an unnamed spring at Cram Creek and have received frequent visits from District specialists due to the heavy resource damage that has been observed in recent years. These areas exhibit bare soil and alteration from trampling in excess of 70 percent, residual stubble heights of less than 2 inches at the end of the grazing season, denuded vegetation, and the presence of annuals and other undesirable plants.

Sediment/Turbidity

Actual direct sediment turbidity monitoring is not a component of standard habitat assessment surveys currently being used by the agency; however, percent fines obtained from pebble count data and percent stable banks is used as a surrogate for sediment and turbidity for smaller particle sizes. Data for estimating sediment conditions are not available for all the streams within the BST. Existing data from the early 1990s and 2000s indicate that percent fines were generally considered as fair throughout the BST with Duncan Creek and Canyon Creek identified as poor at the time. Recent data from 2015 and 2016 indicate poor ratings in Cram Creek and Judy Creek and improving conditions in Canyon Creek rated as good. Existing data from the early 1990s and 2000s indicate that the majority of the streams in

the BST exhibited very stable banks, above 90%; however, recent data indicates an overall downward trend in bank stability in Cram Creek, Canyon Creek (Reaches 1 & 3), Douthit Creek, and Judy Creek. It should be noted that frequent wild horse utilization has been observed in each of these identified systems.

Climate Change Vulnerability Assessment

In 2019, the US Forest Service published the "Climate Change Vulnerability and Adaptation in South-Central Oregon" assessment (Halofsky et al. 2019; General Technical Report PNW-GTR0974). The document assesses the vulnerability of natural resources to climate change and developed adaptation options that minimize the impacts of climate change and facilitate transition of diverse ecosystems to a warmer climate.

In general, the vulnerability assessment shows that the effects of climate change on hydrology in south-central Oregon will be highly significant. Decreased snowpack and earlier snowmelt will shift the timing and magnitude of streamflow; peak flows will be higher, and summer low flows will be lower. Projected changes in climate and hydrology will have far-reaching effects on aquatic and terrestrial ecosystems, especially as frequency of extreme climate events (drought, low snowpack) and ecological disturbances (flooding, wildfire, insect outbreaks) increase.

In the territory, it is predicted that the largest impacts from climate change to hydrology and aquatic species will be in the form of increases to peak flows, warmer mean August stream temperatures, and decreases in snow water equivalent and snow residence times. For example, the eastern side of the territory in the headwaters of the North Fork Crooked River are expected to experience a 20-30% increase in peak flows by 2080, and the rest of the territory is anticipated to see at least a 10-20% increase in that time period. Summer flows are expected to be lower by 2080, with a 20-30% reduction in Upper Ochoco Creek and the headwaters of the North Fork Crooked River. Mean August stream temperatures are expected to also increase by at least 3°C between historic temperatures and 2080. In terms of snowpack, it is predicted there will be a snow-water equivalent percent decrease at the Ochoco Divide SNOTEL site of 90-99%, which is the closest SNOTEL site to the project area (which basically indicates there will be none, to very little snow at this site). It is predicted that there will be a 20-30 day decrease in snow residence time at this site, which likely corresponds closely to the territory due to elevation and proximity.

There are specific actions for minimizing the impacts of climate change to aquatic species and water resources that can apply within the territory. These include: increase the abundance of riparian vegetation along waterbodies, protect springs and other cold water source areas, and improve grazing management by reducing pressure on riparian areas by providing more upland forage.

Environmental Consequences

Three basic factors that have been considered for the environmental consequences are: the effects of horse hoof actions causing shear stress on stream banks (and subsequent disturbance causing sediment exposure and mobilization); horse hoof action through congregating in riparian areas and springs/seeps that cause soil compaction and subsequent reduction in the ability of surface water to percolate into the soils and be retained within the floodplains; and horse browsing on young riparian vegetation that has not reached a height to be able to withstand a certain amount of browsing by large ungulates. These factors can be considered to be common to all of the action alternatives given that horses will remain within the Territory, but the effects will vary in degree by alternative because of more or fewer horses. Analysis assumptions are that more horses will equate to increased bank instability through hoof action, increased soil compaction within the floodplains and around springs, and increased suppression of riparian hardwoods leading to less shade and increased stream temperatures.

Effects Common to All Alternatives

Gathers, such as bait trapping and helicopter assisted gathering, and off-territory management are management plan components included in all alternatives. These actions were analyzed and determined to

have no effect to aquatic species, their habitat, and hydrology. Bait trap and gather locations occur in previously impacted sites such as dispersed campsites. The addition of bait trapping infrastructure and horses for a short period of time will not have additional effects to aquatic species, their habitat, and hydrology because the effects have already been realized at these locations. Additionally, these actions only occur for a short period of time. Therefore, these actions were determined to have no effect and will not be discussed further in the Environmental Consequences section of this report.

Alternative 1 – No Action

Direct and Indirect Effects

Sensitive Species

Redband trout and Columbia spotted frog are vulnerable to direct effects from wild horses. Research suggests preference of feral horses for riparian areas during summer months with the potential for reduction in plant species richness, height, and cover and for alteration of plant community composition (Ganskopp and Vavra, 1986; Crane et al., 1997; Beever and Brussard, 2000). Redband trout and Columbia spotted frogs breed around the same time period from early March to June. Horses can congregate in areas such as wet meadows, riparian areas and streams where Redband trout and Columbia spotted frogs breed and eggs incubate. There is a risk of direct trampling and destruction of eggs. Indirectly, sensitive species habitat is expected to improve as the AML is reduced to 55-65 horses through improvements to width to depth ratios, entrenchment ratios, water temperature/shade and sediment/turbidity. These improvements will increase growth and survival, reproduction rates, and decrease stress in sensitive species. However, until an AML of 55-65 is reached, degradation of habitat that can lead to reduction in suitable habitat through increased width to depth and entrenchment ratios, increased stream temperatures and higher sedimentation is expected. The risk would be reduced as the AML range of 55-65 horses is reached, but lack of current management tools and techniques since 2011 have not enabled sustainable management of the herd.

Sensitive Species Habitat

Too many horses over a small area have been shown to have a negative effect on stream habitat in terms of width to depth and entrenchment ratios due to bank trampling and continual browsing of riparian vegetation that can lead to bank instability that widens streams over time. This leads to wider, shallower streams that are not connected to their floodplain and an overall decrease in pool frequency. As the number of horses decreases back down to an AML of 55-65 from the estimated 135, the effects of wild horse use are expected to be reduced and stream form and function is expected to improve throughout the territory. Fewer horses would mean less impacts to streambank alteration that results in streams downcutting, disconnection from floodplains and channel widening and loss of depth. Improvements in width/depth and entrenchment ratios will ultimately lead towards improved pool frequency.

Stream Temperature

Too many horses over a small area have been shown to have a negative effect on stream temperature by reducing stream shade through the repeated browsing of hardwood vegetation, which results in increased instream temperatures, increasing the potential for thermal stress on Redband trout, Columbia spotted frogs, and other aquatic biota. As the number of horses decreases back to an AML of 55-65 from the estimated 135, the negative effects to stream temperature, shade, and aquatic biota should lessen through the Territory. Fewer horses would results in less browse on hardwood vegetation that is important for shading and cooler temperatures on streams in the Territory, benefitting Redband trout, Columbia spotted frogs, and other aquatic biota.

Riparian Condition, Including Seeps and Springs

Too many horses over a small area have been shown to have a negative effect on riparian areas, wet meadows, seeps, springs and streams due to streambank trampling and year-round utilization of riparian

vegetation. Unlike domestic livestock, wild horse grazing is difficult to manage on a rotational or deferred basis due to difficulties associated with moving horses, resulting in continuous or near-continuous use of rangeland plant communities (Boyd et al. 2017). Strong decreases in shrub populations with unrestricted horse grazing have been previously reported for spring-associated plant communities in Nevada (Beever and Brussard, 2000), and Davies et al. (2014) found decreased sagebrush density in horse-grazed uplands adjacent to riparian areas. Boyd et al. (2017) found that in their study site, which was grazed by horses throughout the year with no fencing to restrict access, horse grazing may be limiting vertical (hardwood) structure of riparian habitats at larger scales. Additionally, Kaweck et al. (2018) found that horses had a greater effect on riparian attributes such as stubble height, streambank disturbance and herbaceous biomass than cattle did in the same area. The larger effect of horses may have been caused by their greater individual forage consumption, which has a subsequently greater impact on vegetation (Kaweck et al. 2018).

As the number of horses decreases back down to an AML of 55-65 from the estimated 135, the effects to riparian vegetation condition will decrease. Fewer horses would mean less utilization of riparian vegetation and trampling of wet meadows, seeps and springs.

Sediment/Turbidity

Too many horses over a small area have been shown to have a negative effect on sediment and turbidity in streams in the Territory due to streambank trampling and continual browsing of hardwood vegetation that causes bank instability that contributes excessive sediment. As the number of horses decrease back to an AML of 55-65 from the estimated 135, the effects to sediment/turbidity (including bank stability) should improve throughout the Territory. Fewer horses would mean less impacts to streambank alteration/unstable banks producing less sediment.

The risk of sediment deposition on eggs of Redband trout and Columbia spotted frog would decrease as horse numbers reach the AML of 55-65. Again, lack of current management tools and techniques since 2011 have not enabled sustainable management of the herd, therefore resulting in double to triple the current AML, attributing to the degradation of riparian and moist meadow habitat in the Territory.

Conclusion

Under Alternative 1, streams, riparian areas and wetland/wet meadows would continue to see similar impacts as the existing condition in the mid- to long-term (estimated in 10 years but is dependent on funding) until horse numbers reach the AML range of 55-65. Once the AML is reached with the limited tools available under this alternative for proper future management of the herd, then habitat for Redband trout and Columbia spotted frog may see a reduction in effects from horses and conditions are expected to improve over time.

Alternative 1 Cumulative Effects

The cumulative effects boundary includes the four subwatersheds that overlap with the Territory (see Figure B-1, Appendix B). All of the activities listed in Table B-1 in Appendix B of the Aquatics Report were considered for the cumulative effects on hydrology, aquatics species and their habitat. Past activities are considered in the description of the existing condition.

In general, beneficial effects from hardwood restoration, stream stabilization/headcut repair and reduction in the road system through travel management and project implementation will benefit riparian areas, streams, wet meadows, and aquatic species habitat in the Territory in localized areas. Some projects will have short-term (defined as less than 1 year) effects to sediment, such as the Ochoco Summit and Walton Lake projects, but long-term will either have no or beneficial effects. Active management of grazing and range improvements in surrounding areas will also minimize effects to bank stability and riparian condition.

Considering all past, present and reasonably foreseeable actions, along with Alternative 1, aquatic habitat, stream form and function, and riparian and wet meadow condition would continue on the same trend until the AML reaches 55-65. Once the AML reaches 55-65, we anticipate that these attributes would begin on an improving trajectory long-term (10 years, but dependent on funding) with the reduction of horses. As discussed in direct and indirect effects, lack of current management tools and techniques since 2011 have not enabled sustainable management of the herd, therefore resulting in double to triple the current AML, attributing to the degradation of riparian and moist meadow habitat in the Territory. For example, Figure 4 shows Douthit Spring in the Territory in September of 2018, an area with documented heavy horse utilization. Impacts at Douthit Spring would continue to persist as shown in the photos. Thus, there will continue to be negative effects to riparian condition, bank stability, sedimentation, stream temperatures and aquatic habitat/channel morphology. Once AML is reached (estimated at 10 years but is dependent on funding) there would be fewer horses congregating at this particular spring though effects would still be present as this is a very productive water source during the driest of summers and consistently selected by horses.

Figure 4: Conditions at Douthit Springs and Douthit Creek in September of 2018.

Determination for Redband Trout and Columbia Spotted Frogs

Based on the above activities that are contributing to cumulative effects, Alternative 1 will have a negative effect on channel morphology, aquatic habitat, stream temperature, riparian condition and sediment/turbidity until the AML of 55-65 is reached. At that point, trends should begin to improve with less horses; however, some attributes such as channel morphology and aquatic habitat recovery will occur over a period greater than 10 years, and may require active restoration at some point in the future to improve conditions in order to realize the ecological benefits sooner. The rate of recovery will be slow, as the reduction of wild horse numbers is expected to be long-term with the tools available in Alternative

1 with only the ability to capture and remove. The determination for both species for Alternative 1 is **May Impact Individuals or Habitat, but not likely to result in loss of viability or a trend toward federal listing (MIIH)** in the short- to mid-term until the proposed AML is reached, but would have a **Beneficial Impact (BI)** in the long-term (10 years, but is dependent on funding) as this alternative reduces effects to riparian condition, sediment/turbidity, stream temperature and channel morphology with the reduction in horses. In some instances, channel morphology and instream aquatic habitat may never fully recover without active restoration, but there will be improvements overall as the number of horses are reduced to AML in Alternative 1.

Consistency with Forest Plan Direction and Other Laws/Regulations

Alternative 1 would increase the chance of obtaining forest plan goals where they are impacting riparian areas and streams as there would be fewer horses in the Territory. Long-term, it would be consistent with the water goals and maintaining cutbank (unstable bank) levels to below 20 percent and maintaining 80 percent shade or 100 percent of potential shade as outlined in the LRMP given that fewer horses would decrease the amount of bank alteration in the form of hoof shear and would decrease the amount of utilization of riparian vegetation.

A review of the standards and guidelines provided in INFISH found that activities in the Big Summit Herd Management Plan are within INFISH requirement and direction long-term when the AML of 55-65 is reached, even though RMOs are currently not being met in the Territory.

GM-4 - Adjust wild horse and burro management to avoid impacts that prevent attainment of Riparian Management Objectives or adversely affect inland native fish.

The four RMOs affected by wild horses in the Big Summit Herd Management Area are pool frequency, water temperature, bank stability and width/depth ratios. Currently, RMOs are not being met in many streams in the Territory. Legacy impacts such as road construction, timber harvest, historic grazing and direct stream manipulation have, in part, caused degradation of RMOs in the Territory. Horses are also having an effect on these RMO attributes through grazing and browse in riparian areas and bank trampling and trailing, especially in areas where frequent use has been observed. A decrease in the number of horses down to an AML of 55-65 will not prevent attainment of RMOs or adversely affect inland native fish because there will be less bank trampling, trailing in riparian areas, and browse of riparian vegetation that have a negative impact on the four RMOs discussed above. Again, lack of current management tools and techniques since 2011 have not enabled sustainable management of the herd, resulting in double to triple the current AML, so it is expected that reaching the AML will be very long-term. Thus, the improvement in RMOs under Alternative 1 is expected to take a long amount of time (over 10 years, and is contingent on funding levels).

Alternative 2

Direct and Indirect Effects

Sensitive Species

As discussed under Alternative 1, Redband trout and Columbia spotted frog are vulnerable to direct effects from wild horses. Redband trout and Columbia spotted frogs breed around the same time period from early March to June. Horses congregate in areas such as wet meadows, riparian areas and streams where Redband trout and Columbia spotted frogs breed and eggs incubate. There is a risk of direct trampling and destruction of eggs under Alternative 2. Indirectly, sensitive species habitat will improve as the AML is reduced to 12-57 horses through improvements to width to depth ratios, entrenchment ratios, water temperature/shade and sediment/turbidity. These improvements will improve growth and survival, reproduction rates, and decrease stress in sensitive species. The risk of direct effects to incubating eggs and indirect effects to instream habitat and water quality is the smallest under Alternative

2 due to the least number of horses on the landscape and the increased availability of management tools to reduce to the AML at the quickest rate.

Sensitive Species Habitat

Too many horses over a small area have been shown to have a negative effect on stream habitat in terms of width to depth and entrenchment ratios due to bank trampling and year-round utilization of riparian vegetation that can lead to bank instability that widens streams over time. This leads to wider, shallower streams that are not connected to their floodplain. As the number of horses decreases down to an AML of 12-57 from the estimated 135, the effects are expected to be reduced and stream form and function is expected to improve throughout the territory. These effects will still be present with a decreased AML; however, they will be on a smaller scale and with less intensity overall. Fewer horses would mean less impacts to streambank alteration that results in streams downcutting, disconnection from floodplains and channel widening and loss of depth. Improvements in width/depth and entrenchment ratios will ultimately lead towards improved pool frequency. The rate of recovery would be faster than Alternative 1 because Alternative 2 allows for more management tools to reduce to the AML at the quickest rate and thus, a lower number of horses would result in a greater reduction of negative effects.

Stream Temperature

Too many horses over a small area have been shown to have a negative effect on stream shade through the repeated browsing of hardwood vegetation and leads to an increase in stream temperatures. As the number of horses decreases down to an AML of 12-57 from the estimated 135, stream temperature and shade should improve throughout the Territory. Fewer horses would mean less browse on hardwood vegetation that is important for shading streams in the Territory. The rate of recovery would be faster than Alternative 1 because Alterative 2 allows more management tools to reduce the AML at the quickest rate. With a lower number of horses there would be a greater reduction of negative effects.

Riparian Condition, Including Seeps and Springs

Too many horses over a small area have been shown to have a negative effect on riparian areas, springs, seeps, wet meadows and streams (see discussion under Alternative 1). The proposed AML in Alternative 2 was established in part from consideration of the poor riparian conditions in wild horse winter range. A decrease in utilization will have a direct benefit to riparian condition in the project area. As the number of horses decreases to an AML range of 12-57, effects to riparian vegetation condition will be reduced and conditions will improve throughout the Territory. These effects will still be present with a decreased AML; however, they will be on a smaller scale and with less intensity overall. This would be evident over time as herbaceous and shrubby understory plants, meadow habitat and riparian vegetation would be expected to receive less trampling and pressure from year-round grazing, and the presence of horses would be expected to decrease significantly from existing levels. The rate of recovery would be faster than Alternative 1 because Alternative 2 allows for more management tools to reduce the AML at the quickest rate. With a lower number of horses there would be a greater reduction of negative effects. It is estimated that Alternative 2 will take 5 years to reach AML but is also dependent on funding. Based on this estimated, it may take 5 years for riparian areas to recover after reaching AML.

As the number of horses decrease to an AML of 12-57 from the estimated 135, the effects to riparian vegetation condition will decrease. Fewer horses would mean less utilization of riparian vegetation and trampling of wet meadows, seeps and springs.

Sediment/Turbidity

Too many horses over a small area have been shown to have a negative effect on sediment and turbidity in streams in the Territory due to bank trampling and repeated browsing of hardwood vegetation that causes bank instability that contributes excessive sediment. As the number of horses decrease to an AML of 12-57 from the estimated 135, effects will be reduced throughout the Territory. Fewer horses would

mean less impacts to streambank alteration/unstable banks producing less sediment. The risk of sediment deposition on eggs of Redband trout and Columbia spotted frog would decrease as the AML of 12-57 is reached. The rate of recovery would be faster than Alternative 1 because Alterative 2 allows for more management tools to reduce the AML at the quickest rate and thus results in a greater reduction of negative effects. With a lower number of horses there would be a greater reduction of negative effects.

Conclusion

Under Alternative 2, streams, riparian areas, springs, seeps and wetland/wet meadows would continue to see similar impacts as the existing condition in the short-term until horse numbers reach the AML range of 12-57 (5 years but is dependent on funding levels). Once the AML is reached, then habitat for Redband trout and Columbia spotted frog may see a reduction in effects from horses and conditions are expected to improve over time. Herd management tools proposed under Alternative 2 will allow for the quickest reduction in herd size, a lower AML, which equates to a greater reduction of negative effects, and will promote faster recovery of heavily impacted riparian areas (such as those seen in Figure 4 in Douthit Springs).

Alternative 2 Cumulative Effects

The cumulative effects boundary includes the four subwatersheds that overlap with the Big Summit Herd Management Area (Territory) (see Figure B-1, Appendix B). All of the activities listed in Table B-1 in Appendix B of the Aquatics Report were considered for the cumulative effects on hydrology, aquatics species and their habitat.

In general, beneficial effects from hardwood restoration, stream stabilization/headcut repair and reduction in the road system through travel management and project implementation will benefit riparian areas, streams, wet meadows and aquatic species habitat in the Territory in localized areas. Some projects will have short-term (less than 1 year) effects to sediment, such as the Ochoco Summit and Walton Lake projects, but long-term will either have no or beneficial effects. Active management of grazing and range improvements in surrounding areas will also minimize effects to bank stability and riparian condition.

Considering all past, present and reasonably foreseeable actions, along with Alternative 2, aquatic habitat, stream form and function, and riparian and wet meadow condition would continue on the same trend until the AML reaches 12-57. Once the AML reaches 12-57, we anticipate that these attributes would begin on an improving trajectory long-term (5 years but is dependent on funding) with the reduction of horses. Herd management tools proposed under Alternative 2 with the lower AML will allow for the quickest reduction in herd size, which equates to greater reduction in negative effects and in turn will promote faster recovery of heavily impacted riparian areas. The rate of recovery to channel morphology, aquatic habitat, stream temperature, riparian condition and sediment/turbidity will be the fastest under Alternative 2.

Determination for Redband Trout and Columbia Spotted Frogs

As horse numbers are reduced and approach the AML of 12-57, negative effects from horse use will correspondingly decrease until riparian conditions begin to improve. At that point, trends should begin to improve at the fastest rate with less horses under Alternative 2; however, some attributes such as channel morphology and aquatic habitat recovery will be very long-term, and may require active restoration at some point in the future to restore within the range of historic variability. The rate of recovery will be faster than Alternative 1 due to the lower AML and increased options in herd management available under Alternative 2. The determination for both species for alternative 2 is **May Impact Individuals or Habitat, but not likely to result in loss of viability or trend toward federal listing (MIIH)** in the short-term (5 years, but is dependent on funding) until the AML is reduced to 12-57 horses, but would have a **Beneficial Impact** mid- to long-term as this alternative reduces effects to riparian condition, sediment/turbidity, stream temperature and channel morphology with the reduction in horses. In some instances, channel morphology and instream aquatic habitat may never fully recover without active

restoration, but there will be improvements overall as the number of horses are reduced to AML in Alternative 2. Alternative 2 would have the fastest recovery to Redband trout and Columbia spotted frog due to the lower AML and availability of additional management actions to reduce herd size at the fastest rate.

Consistency with Forest Plan Direction and Other Laws/Regulations

Alternative 2 would be consistent with the Ochoco National Forest Plan in the mid- to long-term when the AML of 12-57 is reached. It would be consistent with the water goals and maintaining cutbank (unstable bank) levels to below 20 percent and maintaining 80 percent shade or 100 percent of potential shade as outlined in the LRMP given that fewer horses would decrease the amount of bank alteration in the form of hoof shear and would decrease the amount of browsing on riparian vegetation.

A review of the standards and guidelines provided in INFISH found that activities in the Big Summit Herd Management (Territorial) Plan are within INFISH requirement and direction when the AML of 12-57 is reached.

GM-4 - Adjust wild horse and burro management to avoid impacts that prevent attainment of Riparian Management Objectives or adversely affect inland native fish.

The four RMOs affected by wild horses in the Big Summit Herd Management Area are pool frequency, water temperature, bank stability and width/depth ratios. Currently, RMOs are not being met in many streams in the Territory. Legacy impacts such as road construction, timber harvest, historic grazing and direct stream manipulation have, in part, caused degradation of RMOs in the Territory. Horses are also having a negative effect on these RMO attributes through grazing and utilization of riparian areas and bank trampling and trailing. A decrease in the number of horses down to an AML of 12-57 is not expected to retard or prevent attainment of RMOs or adversely affect inland native fish because there will be less bank trampling, trailing in riparian areas, and utilization of riparian vegetation that have a negative impact on the four RMOs discussed above . This alternative will take the shortest amount of time for recovery of RMOs due to reduced AML and additional management actions available to reduce herd size at the fastest rate.

Alternative 3

Direct and Indirect Effects

Sensitive Species

Redband trout and Columbia spotted frog are vulnerable to direct effects from wild horses. Redband trout and Columbia spotted frogs breed around the same time period from early March to June. Horses can congregate in areas such as wet meadows, riparian areas and streams where Redband trout and Columbia spotted frogs breed and eggs incubate. There is a risk of direct trampling and destruction of eggs. Indirectly, sensitive species habitat is expected to continue to degrade through continued impacts to width to depth ratios, entrenchment ratios, water temperature/shade and sediment/turbidity. These impacts will continue to effect growth and survival, reproduction rates, and increase stress in sensitive species. The risk of direct trampling and destruction of eggs and indirect effects to aquatic habitat and water quality is the highest under Alternative 3 because this alternative allows for the highest number of horses in the Territory; therefore, the highest corresponding amount of potential degradation to eggs.

Sensitive Species Habitat

Too many horses over a small area have been shown to have a negative effect on stream habitat in terms of width to depth and entrenchment ratios due to bank trampling and year-round utilization of riparian vegetation that can lead to bank instability that widens streams over time. This leads to wider, shallower streams that are not connected to their floodplain. As the number of horses increase to an AML of 150-200 from the estimated 135, the effects will increase, and conditions will decline in the Territory. More

horses would mean more impact to streambank alteration which results in stream downcutting, disconnection from the floodplain and stream channel widening and corresponding reduction in overall stream depth. Degradation in stable width/depth and entrenchment ratios will ultimately lead towards decreased pool frequency.

Stream Temperature

Too many horses over a small area have been shown to have a negative effect on stream shade through the repeated browsing of hardwood vegetation and leads to an increase in stream temperatures. As the number of horses increase to an AML of 150-200 from the estimated 135, the effects will increase and conditions will degrade throughout the Territory. More horses would mean more browse on hardwood vegetation that is important for shading of streams in the Territory.

Riparian Condition, Including Seeps and Springs

Too many horses over a small area have been shown to have a negative effect on riparian areas, wet meadows and streams (see discussion under Alternative 1). Alternative 3 would have the most detrimental effects to riparian vegetation condition, bank stability (and in turn sediment production), stream form and function, aquatic habitat and stream temperatures in the Territory. The risk of sediment deposition on eggs of Redband trout and Columbia spotted frog would be the highest as compared to Alternatives 1 and 2. Where occurring, the rate of recovery of many of the streams, riparian areas and wet meadows in the Territory would be either slowed or eliminated with the AML of 150-200 horses. In some cases, areas may continue to degrade with a negative rate of recovery. For example, Cram Creek on the east side of the territory is at risk of continued degradation with an increased number of horses (Figure 5).

Figure 5: Perennial spring in the vicinity of Cram Creek that has documented heavy horse utilization.

Sediment/Turbidity

Too many horses over a small area have been shown to have a negative effect on sediment and turbidity in streams in the Territory due to bank trampling and repeated browsing of hardwood vegetation that causes bank instability that contributes excessive sediment. As the number of horses increase to an AML of 150-200 from the estimated 135, the effects will increase, and the conditions will continue to degrade throughout the Territory. More horses would be expected to result in more streambank alteration/unstable

banks producing more sediment. The risk of sediment deposition on eggs of Redband trout and Columbia spotted frog would increase as the AML reaches 150-200.

Alternative 3 Cumulative Effects

The cumulative effects boundary includes the four subwatersheds that overlap with the Big Summit Herd Management Area (Territory) (Appendix B, Figure B-1). All of the activities listed in Table B-1 in Appendix B of the Aquatics Report were considered for the cumulative effects on hydrology, aquatics species and their habitat.

In general, beneficial effects from hardwood restoration, stream stabilization/headcut repair and reduction in the road system through travel management and project implementation will benefit riparian areas, streams, wet meadows and aquatic species habitat in the Territory in localized areas. Some projects will have short-term (less than 1 year) effects to sediment, such as the Ochoco Summit and Walton Lake projects, but long-term will either have no or beneficial effects. Active management of grazing and range improvements in surrounding areas will also minimize effects to bank stability and riparian condition.

Considering all past, present and reasonably foreseeable actions, along with Alternative 3, aquatic habitat, stream form and function, and riparian and wet meadow condition would be expected to degrade within the Territory. These attributes would be on a declining trajectory long-term with the increase in AML. For example, conditions would be expected to be exacerbated at places like Douthit Spring and Creek, and Cram Creek as shown in Figure 4 and Figure 5.

Determination for Redband Trout and Columbia Spotted Frogs

Based on the above activities that are contributing to cumulative effects, Alternative 3 is expected to have a negative effect on channel morphology, aquatic habitat, stream temperature, riparian condition and sediment/turbidity. In some instances, the rate of recovery that is being seen in some areas in the territory will either be reduced or eliminated to a point where recovery is no longer occurring. The determination for both species for alternative 3 is **May Impact Individuals or Habitat, but not likely to result in loss of viability or a trend toward federal listing (MIIH)**. This determination is based on approximately 4% of their habitat on the Ochoco National Forest is located within the Territory. Long-term, Alternative 3 is expected to have the greatest adverse impact to Redband trout and Columbia spotted frog, and over the long-term riparian, stream and wet meadow conditions would be expected to be degraded, reducing the availability of quality habitat for Redband trout and Columbia spotted frog.

Consistency with Forest Plan Direction and Other Laws/Regulations

Alternative 3 would not be consistent with the Ochoco National Forest Plan. Long-term, it is expected that cutbank levels and shade would be reduced due to an increased number of horses. Thus, it is inconsistent with the water goals and maintaining cutbank levels to below 20 percent and maintaining 80 percent shade or 100 percent of potential shade as outlined in the LRMP.

A review of the standards and guidelines provided in INFISH found that activities in the Big Summit Herd Management (Territorial) Plan is not within INFISH requirement and direction long-term.

GM-4 - Adjust wild horse and burro management to avoid impacts that prevent attainment of Riparian Management Objectives or adversely affect inland native fish.

The four RMOs affected by wild horses in the Territory are pool frequency, water temperature, bank stability and width/depth ratios (Table 7). Currently, RMOs are not being met in many streams in the Territory. Legacy impacts such as road construction, timber harvest, historic grazing and direct stream manipulation have, in part, caused degradation of RMOs in the Territory. Horses are also having an effect on these RMO attributes through grazing and browse in riparian areas and bank trampling and trailing. An increase in the number of horses would prevent attainment of RMOs and may adversely affect inland native fish through the reduction of high-quality habitat, including spawning habitat.

Table 7: Impacts to selected indicators (up arrow indicates an improving trend and down arrow indicates a downward/degrading trend)

Rate of change 5-10 years / >10 years	Sensitive Species (Redband Trout & Columbia Spotted Frog)	Sensitive Species Habitat	Stream Temp (Max Ave Daily Temp F)	Riparian Condition	Sediment /Turbidity
Alternative #1	↑	↑	↑	↑	↑
Alternative #2	↑	↑	↑	↑	↑
Alternative #3	↓	↓	↓	↓	↓

Aquatic Management Indicator Species (MIS) Viability Analysis

Fish species identified as management indicator species are listed in the FEIS for the Forest Plan. These species are rainbow trout (*Oncorhynchus mykiss*) and brook trout (*Salvelinus fontinalis*). In the past, these fish have been stocked by the Oregon Department of Fish and Wildlife. They are no longer stocked in the streams in the Territory but may naturally reproduce in many streams (Classes I and II). For purposes of this analysis, effects to Redband trout will act as a surrogate for MIS fish species. No further evaluation for brook trout will be discussed in this section.

Riparian ecosystems occur at the margins of standing and flowing water, including intermittent stream channels, ephemeral ponds, and wetlands. The aquatic MIS were selected to indicate healthy stream and riparian ecosystems across the landscape. Attributes of a healthy aquatic ecosystem includes: cold and clean water; clean channel substrates; stable streambanks; healthy streamside vegetation; complex channel habitat created by large wood, cobbles, boulders, streamside vegetation, and undercut banks; deep pools; and waterways free of barriers. Healthy riparian areas maintain adequate temperature regulation, nutrient cycles, natural erosion rates, and provide for instream wood recruitment.

The existing condition of Redband trout habitat and extent of Redband trout populations in the project area is displayed in the section of this report titled "Existing Condition". Refer to this section of the report for more information on conditions for Redband trout in the project area.

Limiting factors and threats for Redband trout are similar throughout their range on the Ochoco National Forest and Crooked River National Grassland. The predominate threats are increases in stream temperature due to channel degradation due to riparian area management issues and population fragmentation from upstream passage issues mostly related to culverts at stream crossings.

Causal factors include legacy impacts from past heavy grazing, logging and road building in the 20th century. In most cases channels are currently recovering from these impacts, especially grazing and logging; however, road building issues that constricted floodplains continue to cause impacts to fish habitat. Road crossings on the Ochoco are being replaced on a yearly basis with over 60 culverts either removed or replaced in the last 16 years. This has increased the ability of Redband trout to move freely within and between watersheds.

There are no models developed to determine viability of the Redband trout based on habitat. However, based on the local science from Stuart et al. (2007) and the estimated habitats from the Inter-Columbia Basin Management Plan there appears to be appropriate habitat that is well distributed and available for Redband trout across the Ochoco National Forest. In conclusion, the viability assessment indicates that habitat of the Redband trout is still available in adequate amounts, distribution, and quality to maintain Redband trout viability on the Ochoco National Forest and Crooked River National Grassland.

This project will have no effect on fragmentation because there is no road construction or other activities that would restrict free movement of Redband trout into other habitats. In terms of stream temperatures, Alternative 1 will improve long-term stream temperatures in the project area, but this is expected to be very long-term, as lack of current management tools and techniques since 2011 have not enabled sustainable management of the herd.

If the herd is reduced to 55-65, stream temperatures long-term could recover. Alternative 2 will lead to the fastest improvement in stream temperatures, but again, this is mid-to long-term recovery until the herd is reduced to the appropriate AML. Then the response of riparian hardwood vigor would take several years before benefits are realized. Alternative 3 would lead to a degradation in hardwood shade long-term with an increase in the number of horses in the territory. This is expected to increase stream temperatures in the territory and long-term could be detrimental to Redband trout within the project area. Because of the expansive nature of Redband trout on the Forest, their populations would remain viable under all alternatives, but Alternative 3 may reduce Redband trout populations in the Territory through increased stream temperatures that are uninhabitable.

Climate Change Effects

Based on the climate change vulnerability assessment, streams in the project area are expected to see increases in peak flows, warmer summer water temperatures, and reduced summer flows. Currently, too many horses over a relatively small area are having a negative impact on the resiliency of the landscape to climate change due to impacts on riparian areas, wet meadows, seeps, springs and streams (e.g. streambank trampling and year-round utilization of riparian vegetation). Alternative 1 will reduce the herd to 55-65 but is estimated to take 10 years to get down to an AML of 55-65, so until then, the resiliency of the territory to climate change will be adversely impacted. Alternative 2 proposes a smaller AML and will only take 5 years to achieve (depending on funding), so it is expected that the territory will become more resilient to climate change at a faster rate. Alternative 3 proposes a larger AML and is anticipated to have continual degradation of riparian areas, seeps, springs and streams due to horses. This alternative will continue to lead to a less resilient landscape in the face of climate change in the territory.

References

Beschta, R.L.; Bilby, R.E.; Brown, G.W.; Holtby, L.B.; and, Hofstra, T.D. 1987. Stream temperature and aquatic habitat: fisheries and forestry interactions. In: Streamside Management: Forestry and Fishery Interactions, Salo EO, Cundy TW (eds). Institute of Forest Resources, Univeristy of Washington. Seattle, WA. 191-232.

Beever, E.A. and P.F. Brussard. 2000. Charismatic megafauna or exotic pest? Interactions between popular perceptions of feral horses (Equus caballus) and their management and research. Conference Paper. Northern Rocky Mountain Science Center. Vol. 19, pp 413-418. *need to get article

Bjorn, T. C., and D. W. Reiser. 1991. Habitat requirements of salmonids in streams. Pages 83–138 in W. R. Meehan, editor. Influences of forest and rangeland management on salmonid fishes and their habitat. Special publication 19. American Fisheries Society, Bethesda, Maryland, USA.

Boyd, C.S., Davies, K.W., and G.H. Collins. 2017. Impacts of feral horse use on herbaceous riparian vegetation within a sagebrush steppe ecosystem. Rangeland Ecology and Management. Vol. 70, Issue 4, pp 411-417.

Clifton, C. 1989. Effects of vegetation and land use on channel morphology. In: Gresswell, R.E., B.A. Barton, J.L. Kershner, eds. Riparian resource management. Billings, MT: U.S. Department of the Interior, Bureau of Land Management: 121-129.

Crane, K.K, Smith, M.A., and D. Reynolds. 1997. Habitat selection of feral horses in Southcentral Wyoming. Journal of Range Management, Vol. 50, No. 4 (Jul., 1997), pp 374-380.

Davies, K. W. and C.S. Boyd. 2019. Ecological Effects of Free-Roaming Horses in North American Rangelands. Bioscience 69: 558-565.

Davies, K. W., G. Collins, and C. S. Boyd. 2014. Effects of feral free-roaming horses on semi-arid rangeland ecosystems: an example from the sagebrush steppe. Ecosphere 5(10):127

Deal, R.L. and C.A. Harrington, eds. 2006. Red Alder-a state of knowledge. Gen. Tech. Rep. PNW-GTR-669. Portland, OR: U.S. Department of Agriculture, Pacific Northwest Research Station. 150 p.

Duff, D.A. 1979. Riparian habitat recovery on Big Creek, Rich County, Utah. In: Proc., Forum-Grazing and Riparian/ Stream Ecosystems. Trout Unlimited, Inc. p. 91.

Gamperl, A. K., Rodnick, K. J., Faust, H. A., Venn, E. C., Bennett, M. T., Crawshaw, L. I., Keeley, E. R., Powell, M. S. and Li, H.W. 2002. Metabolism, swimming performance, and tissue biochemistry of high desert redband trout (Oncorhynchus mykiss ssp.): Evidence for phenotypic differences in physiological function. Physiological and Biochemical Zoology 75, 413–431. (*need to get article)

Ganskopp, D. and M. Vavra. 1986. Habitat use by feral horses in the Northern sagebrush steppe. Journal of Range Management, Vol. 39, No. 3 (May 1986), pp 207-212.

Halofsky, Jessica E.; Peterson, David L.; Ho, Joanne J., eds. 2019. Climate change vulnerability and adaptation in south-central Oregon. Gen. Tech. Rep. PNW-GTR-974. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 473 p.

Harrington, C.A., J.C. Zasada, and E.A. Allen. 1994. Biology of red alder (Alnus rubra Bong.). Pages 3-22 in Hibbs, D.E., D.S. DeBell, and R.F. Tarrant, eds. The Biology and Management of Red Alder. Corvallis, OR: Oregon State University Press. 256 p.

Idaho Power Company. 2003. Redband Trout and Bull Trout Associated with the Hells Canyon Complex. Technical Report Appendix C.3. 1-7, 184 pp.

Kaweck, M.M., J.P Severson, and K.L. Launchbaugh. 2019. Impacts of Wild Horse, Cattle, and Wildlife on Riparian Areas in Idaho. Rangelands 40(2): 45-52.

Oregon Department of Environmental Quality (ODEQ). 2010. Oregon's 2010 Integrated Report. http://www.deq.state.or.us/wq/assessment/rpt2010/search.asp

Marcuson, P.E. 1977. "The Effect of Cattle Grazing on Brown Trout in Rock Creek, Montana." Fish and Game Fed. Aid Pro. F-20-R-21-11a.

Megahan, W. F. 1974. Erosion over time on severely disturbed granitic soils: a model. Res. Pap. INT-156. Ogden, UT: U.S. Department of Agriculture, Intermountain Forest and Range Experiment Station. 14 p.

Megahan, W.F. and King, J. G. 2004. Erosion, sedimentation, and cumulative effects in the Northern Rocky Mountains. In: Ice, G.G and Stednick, J.D. [Eds.]. A Century of Forest and Wildland. Watershed Lessons. Bethesda, MD. Society of American Foresters. 9:201-222. (*need to get article)

Montgomergy, D.R., J.M. Buffington, R.D. Smith, K.M. Schmidt, and G. Pess. 1995. Pool spacing in forest channels. Water Resources Research 31: 1097-1105.

Rodnick, K.J.; Gamperl, A.K.; Lizars, K.R.; Bennett, M.T.; Rausch, R.N.; and, Keeley, E.R. 2004. Thermal tolerance and metabolic physiology among redband trout populations in south-eastern Oregon. Journal of Fish Biology, 64: 310–335.

Rosgen, D. L. 1996. Applied River Morphology. Wildland Hydrology. Pagosa Springs, Colorado.

Rosgen, D. and L. Silvey. 1998. Field Guide for Stream Classification. Wildland Hydrology. p. 193.

Seixas, G.B., C.N. Veldheisen and M. Olis. 2020. Wood controls on pool spacing, step characteristic and sediment storage in headwater streams of the northwestern Cascade Mountains. Geomorphology 348: 1-11.

Stuart, A.M., D. Grover, T.K. Nelson, and S.L. Thiesfeld. 2007. Redband trout investigations in the Crooked River basin. Pages 76–91 in R.K. Schroeder and J.D. Hall, editors. Redband trout: resilience and challenge in a changing landscape. Oregon Chapter, American Fisheries Society, Corvallis.

USDA. Forest Service. 2012. National Best Management Practices for Water Quality Management on National Forest System Lands. USDA Forest Service, FS-990a, (BMP 2012)

USDA Forest Service. 1989. Final Environmental Impact Statement: Land and Resource Management Plan, Ochoco National Forest and Crooked River National Grassland. U.S.D.A. Forest Service, Pacific Northwest Region. August.

USDA Forest Service. 1992. The Bottom Line Survey. An approach to evaluate the attainment of riparian area standards and guidelines on the Ochoco National Forest. R-6 Fish Habitat Relationship Technical Bulletin Number 2.

USDA Forest Service. 1995a. Inland Native Fish Strategy (INFISH) Environmental Assessment. Decision Notice and Finding of No Significant Impact. Intermountain, Northern and Pacific Northwest Regions.

USDA Forest Service. 1995b. Anadromous Fish Strategy (PACFISH) Environmental Assessment. Decision Notice and Finding of No Significant Impact. Intermountain, Northern and Pacific Northwest Regions.

USDA Forest Service. 2011. Watershed Condition Classification Technical Guide. FS-978. p. 49.

USDA Forest Service. 2011a. Regional Forester's Sensitive Species List. Unpublished report for the Pacific Northwest Region. http://www.fs.fed.us/r6/sfpnw/issssp/agency-policy/

USDA Forest Service. 2019. PACFISH/INFISH Biological Opinion (PIBO) Effectiveness Monitoring Data. http://fsweb.r4.fs.fed.us/unit/nr/pibo/index.shtml

U.S. Department of the Interior. 2015. Riparian area management: Proper functioning condition assessment for lotic areas. Technical Reference 1737-15. Bureau of Land Management, National Operations Center, Denver, CO.

USDI Fish and Wildlife Service. 2011. U.S. Fish and Wildlife Service Species Assessment and Listing Priority Assignment Fork for Columbia Spotted Frog. https://www.fs.fed.us/r6/sfpnw/issssp/documents/planning-docs/cp-fws-candidate-ha-rana-luteiventris-2011-04.pdf

Wydoski, R. S., and R. R. Whitney. 1979. Inland Fishes of Washington.

APPENDICES

Appendix A. Watershed Condition Framework Ratings for each of the four subwatersheds that comprise the Big Summit Territory for Wild Horses.

Table A-1. Watershed Condition Framework (WCF) ratings for the Howard Creek Subwatershed.

WCF Measurement Indicators	Tracking WCF Labels	Rating Value	Howard Creek Subwatershed
Aquatic Biota Condition	Indicator Aquatic Bio Biota	1.3	Good
Riparian/Wetland Veg Condition	Indicator Aquatic Bio Rip Veg	2.0	Fair
Water Quality Condition	Indicator Aquatic Phys Water Qual	2.5	Poor
Water Quantity Condition	Indicator Aquatic Phys Water Qnty	1.0	Good
Aquatic Habitat Condition	Indicator Aquatic Phys Habitat	2.0	Fair
Road and Trail Condition	Indicator Terr Phys Road Trail	1.8	Fair
Soil Condition	Indicator Terr Phys Soils	1.0	Good
Fire Regime or Wildfire Condition	Indicator Terr Bio Fire	1.0	Good
Forest Cover Condition	Indicator Terr Bio ForCover	1.0	Good
Forest Health Condition	Indicator Terr Bio ForHealth	1.0	Good
Terrestrial Invasive Species Condition	Indicator Terr Bio Invasive	1.0	Good
Rangeland Condition	Indicator Terr Bio Range	1.0	Good
Overall WCF Rating		**Old 1.6/New 1.8**	**Fair**

1-1.6 (Class 1/Good), 1.7-2.2 (Class 2/Fair), 2.3-3.0 (Class 3/Poor)

Table A-2. Watershed Condition Framework (WCF) ratings for the Headwaters Ochoco Creek Subwatershed.

WCF Measurement Indicators	Tracking WCF Labels	Rating Value	Headwaters Ochoco Creek Subwatershed
Aquatic Biota Condition	Indicator Aquatic Bio Biota	1.3	Good
Riparian/Wetland Veg Condition	Indicator Aquatic Bio Rip Veg	2.0	Fair
Water Quality Condition	Indicator Aquatic Phys Water Qual	2.5	Poor
Water Quantity Condition	Indicator Aquatic Phys Water Qnty	2.0	Fair
Aquatic Habitat Condition	Indicator Aquatic Phys Habitat	2.7	Poor
Road and Trail Condition	Indicator Terr Phys Road Trail	2.5	Poor
Soil Condition	Indicator Terr Phys Soils	1.7	Fair
Fire Regime or Wildfire Condition	Indicator Terr Bio Fire	1.0	Good
Forest Cover Condition	Indicator Terr Bio ForCover	1.0	Good
Forest Health Condition	Indicator Terr Bio ForHealth	1.0	Good
Terrestrial Invasive Species Condition	Indicator Terr Bio Invasive	1.0	Good
Rangeland Condition	Indicator Terr Bio Range	1.0	Good
Overall WCF Rating		**Old 1.9/New 2.1**	**Fair**

1-1.6 (Class 1/Good), 1.7-2.2 (Class 2/Fair), 2.3-3.0 (Class 3/Poor)

Table A-3. Watershed Condition Framework (WCF) ratings for the Duncan Creek-Ochoco Creek Subwatershed.

WCF Measurement Indicators	Tracking WCF Labels	Rating Value	Duncan Creek-Ochoco Creek Subwatershed
Aquatic Biota Condition	Indicator Aquatic Bio Biota	1.3	Good
Riparian/Wetland Veg Condition	Indicator Aquatic Bio Rip Veg	2.0	Fair
Water Quality Condition	Indicator Aquatic Phys Water Qual	2.0	Fair
Water Quantity Condition	Indicator Aquatic Phys Water Qnty	2.0	Fair
Aquatic Habitat Condition	Indicator Aquatic Phys Habitat	1.7	Fair
Road and Trail Condition	Indicator Terr Phys Road Trail	2.3	Poor
Soil Condition	Indicator Terr Phys Soils	1.7	Fair
Fire Regime or Wildfire Condition	Indicator Terr Bio Fire	1.0	Good
Forest Cover Condition	Indicator Terr Bio ForCover	1.0	Good
Forest Health Condition	Indicator Terr Bio ForHealth	1.0	Good
Terrestrial Invasive Species Condition	Indicator Terr Bio Invasive	1.0	Good
Rangeland Condition	Indicator Terr Bio Range	1.0	Good
Overall WCF Rating		**Old 1.8/New 1.8**	**Fair**

1-1.6 (Class 1/Good), 1.7-2.2 (Class 2/Fair), 2.3-3.0 (Class 3/Poor)

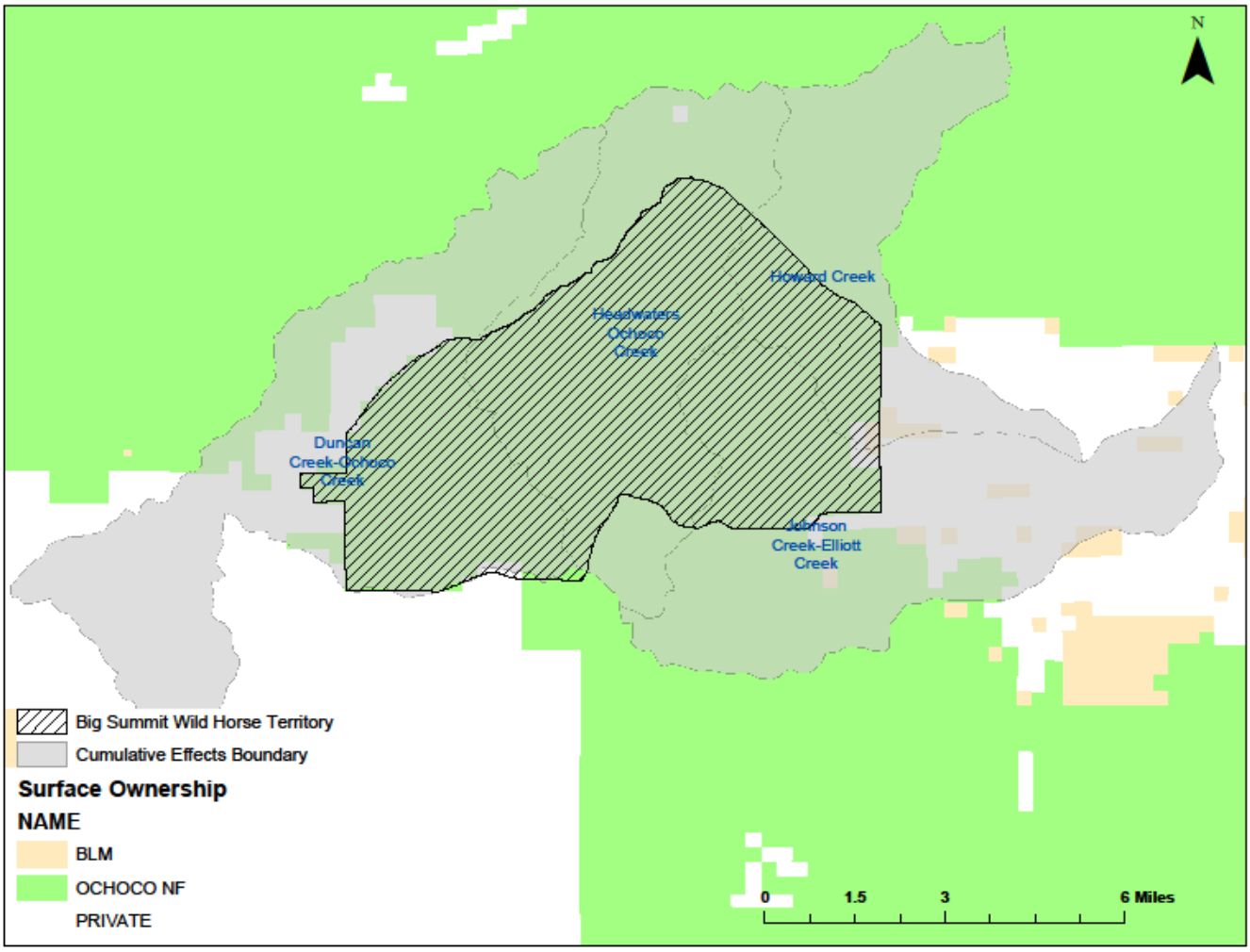
Table A-4. Watershed Condition Framework (WCF) ratings for the Johnson Creek-Elliott Creek Subwatershed.

WCF Measurement Indicators	Tracking WCF Labels	Rating Value	Johnson Creek-Elliott Creek Subwatershed
Aquatic Biota Condition	Indicator Aquatic Bio Biota	1.3	Good
Riparian/Wetland Veg Condition	Indicator Aquatic Bio Rip Veg	3.0	Poor
Water Quality Condition	Indicator Aquatic Phys Water Qual	1.5	Good
Water Quantity Condition	Indicator Aquatic Phys Water Qnty	1.0	Good
Aquatic Habitat Condition	Indicator Aquatic Phys Habitat	2.0	Poor
Road and Trail Condition	Indicator Terr Phys Road Trail	2.3	Poor
Soil Condition	Indicator Terr Phys Soils	1.3	Good
Fire Regime or Wildfire Condition	Indicator Terr Bio Fire	1.0	Good
Forest Cover Condition	Indicator Terr Bio ForCover	1.0	Good
Forest Health Condition	Indicator Terr Bio ForHealth	1.0	Good
Terrestrial Invasive Species Condition	Indicator Terr Bio Invasive	1.0	Good
Rangeland Condition	Indicator Terr Bio Range	1.0	Good
Overall WCF Rating		**Old 1.7/New 1.8**	**Fair**

1-1.6 (Class 1/Good), 1.7-2.2 (Class 2/Fair), 2.3-3.0 (Class 3/Poor)

Appendix B. Cumulative Effects Spatial Bounding

Figure B-1. Cumulative effects boundary for hydrology and aquatic species resources. This cumulative effects boundary encompasses the four subwatersheds that overlap with the Big Summit Herd Management Area. Portions of these subwatersheds are outside of the herd management area; however, they are still part of the cumulative effects boundary. For example, sedimentation from horse hoof action on stream banks may travel downstream outside of the herd management area and have an effect on aquatic species and habitat.



Future and Ongoing Projects

Table B- 1. Activities that may cumulatively contribute to effects from the Big Summit Wild Horse Territory Management Plan Update.

Project	Activities	Year	Cumulative Effect
Canyon Fuels & Vegetation Management Project (ROD, 2010)	Commercial and non-commercial vegetation management and fuels reduction; hardwood and upland shrub restoration and road management	Implementation	No cumulative effect from commercial timber harvest, non-commercial fuels reduction through thinning and prescribed fire. Hardwood restoration will have a beneficial cumulative effect on riparian vegetation condition and shade, which long-term will improve stream temperatures. Road management through closures and decommissioning will have a long-term benefit in sediment reductions.
Howard Elliott Johnson Fuels & Vegetation Management Project (ROD, 2011)	Commercial and non-commercial vegetation management and fuels reduction; stream stabilization/headcut repair, hardwood and upland shrub restoration and road management	Implementation	No cumulative effect from commercial timber harvest, non-commercial fuels reduction through thinning and prescribed fire. Stream stabilization and headcut repair will have a long-term benefit to bank stability (and in turn sediment), channel morphology, aquatic habitat and riparian condition. Hardwood restoration will have a beneficial cumulative effect on riparian vegetation condition and shade, which long-term will improve stream temperatures. Road management through closures and decommissioning will have a long-term benefit in sediment reductions.
Travel Management FEIS (ROD, 2011)	Established designated road and trail system (MVUM). Established conditions for motorized access for dispersed camping.	Implementation	Long-term beneficial effect. Travel management will continue to limit cross-country motorized access. These restrictions help reduce sediment and degradation of riparian and wet meadow habitats from off-road vehicle use throughout the year.
Invasive Plant Treatments FEIS (ROD, 2012)	Reduces the extent of specified invasive plant infestations at identified sites and protects areas not yet infested from future introduction and spread.	Implementation	Long-term beneficial effect. Treatment of invasive species in riparian and wet meadow areas improves overall riparian condition.

Project	Activities	Year	Cumulative Effect
Powerline Maintenance	Maintenance includes removal of trees near powerlines, sometimes within RHCAs	Ongoing	Minor long-term degradation where powerlines are located within riparian corridors. Vegetation removal reduces shade and riparian condition.
Ochoco Summit Trail System	Establish a designated off-highway vehicle trail system across the Forest	Planning	Minor short-term degradation followed by long-term beneficial effect. Construction of trail system within RHCAs may increase sediment levels during the time of construction. Long-term reduction in unauthorized trails and continual maintenance of authorized trail system will have a beneficial effect on sediment levels and riparian condition long-term.
Walton Lake Restoration Project	Improve forest health and public safety through the removal of diseased trees within the Walton Lake developed recreation area	Planning	Short-term negative effects to sediment during implementation during log hauling activities. Effects are limited in scale and duration. Project design criteria and mitigations will limit effects to riparian areas and streams.
Blue Mountains Forest Resiliency Project	Proposing to use thinning and low severity fire in dry forest habitat on about 118,000 acres across the Ochoco National Forest	Planning	No effect from thinning and low severity fire because treatment areas are outside of RHCAs. Short-term degradation in sediment from log haul during implementation. Most of the sediment impacts will be mitigated through proper road maintenance prior and after hauling operations.
Reservoir Allotment Sheep Grazing	Authorization of sheep grazing on the Ochoco National Forest within the Herd Management Area	Ongoing	Sheep grazing has minimal long-term detrimental effects in the Territory. Sheep use riparian areas in the Territory, so there is a minor impact to riparian vegetation from incidental browse and bank stability where sheep congregate. However, sheep never stay in one place for more than a day, so the impacts are very short-term and minimal.
Crystal Springs, Elkhorn and Brush Creek Cattle Allotments	Authorization of cattle grazing on the Ochoco National Forest outside of the Herd Management Area but within the cumulative effects boundary	Ongoing	Cattle cause effects to streams through browse on riparian vegetation and bank trampling when they congregate in riparian areas and wet meadows. They can cause stream instability and increase sedimentation downstream. Active management is required in all surrounding allotments, so this allows for improved management of livestock

Project	Activities	Year	Cumulative Effect
			through continual movement out of riparian areas, leading to less impacts. Range improvements, including riparian restoration, habitat protection, water developments, and fence reconstruction would occur within existing allotment. These activities are expected to improve the current condition of the riparian and adjacent meadow habitats, and potentially improve the connectivity of riparian habitats. In summary, there are negative effects from cattle grazing, but those effects are minimized through active management and range improvements.